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ABSTRACT

This document consists of the teacher's guide to a module designed to teach high school students entry-level job competencies in the new areas of agriculture that are now emerging. The module, one of a series of publications designed to identify these new competencies, contains 11 instructional units that cover the following topics: trends in agricultural food products; general safety practices; meat products; poultry products; dairy products; fish and fish products; fruit and vegetable products; grain products; packing agricultural products; preserving agricultural products; and specialized and nonfood agricultural products. Each instructional unit follows a standard format that includes some or all of these 13 basic components: performance objectives, suggested activities, basic academic skills taxonomy, handouts, information sheets, supplements, transparency masters, assignment sheets, assignment sheet answers, job sheets, practical tests, written tests, and written test answers. All of the unit components focus on measurable and observable learning outcomes and are designed for use in more than one lesson or class period. (KC)

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Teacher Edition

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Introduction To Agricultural Products and Processing

Developed by the
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PREFACE

It is recognized today that nearly 20 percent of the U.S. population is employed in some aspect of agriculture. Agriculture will never be far removed from the land, but the same technology that brings us hybrid wheat also compels us to broaden the view of agriculture to include the labs and designing tables. The agriculturalist of the future may originate new uses for cotton or devise more efficient packaging for foods.

While many opportunities exist for today's student of agriculture, it become essential to have a "big picture" view. Today's teacher of agricultural education has the task of not only laying the foundation by teaching the skills of production but introducing the many new opportunities that exist as well.

Randy Kirk, Curriculum Specialist
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USE OF THIS PUBLICATION

INSTRUCTIONAL UNITS

Introduction to Agricultural Products and Processing contains eleven units. Each instructional unit includes some or all of the basic components of a unit of instruction: performance objectives, suggested activities, basic academic skills taxonomy, handouts, information sheets, supplements, transparency masters, activity sheets, assignment sheets, assignment sheet answers, job sheets, practical tests, written tests, and written test answers. Practical tests and written tests are included in the instructor edition only, and may be duplicated for classroom use or copies may be purchased in Oklahoma by calling 800-522-5810. Out-of-state instructors may order test packets by calling 800-654-4502.

All of the unit components focus on measurable and observable learning outcomes. Instructors are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the instructor will help him or her determine the following:

- Amount of material that can be covered in a class period
- Skills that must be demonstrated
  - Supplies and equipment needed
  - Amount of class time needed for demonstrations
  - Amount of time needed for student practice
- Supplementary materials, including print and non-print media to be ordered
- Resource people to be contacted

Objective Sheets (White Pages)

Each unit of instruction is based on performance objectives. Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction, and specific objectives, stating the performance necessary to meet the unit objective.

The unit objective states the overall goal of the unit. It tells what the student should be able to do and what standard will be used to determine whether the student has achieved competency. Specific objectives outline the teaching sequence of the competencies required to meet the unit objective.

The objectives should be provided for students and their importance stressed throughout the teaching/learning process. By doing this, instructors will help answer any questions concerning performance requirements for each instructional unit. Instructors can also use the objectives to plan teaching strategies and instructional methods. Instructors should prepare for each unit by deciding how each objective can best be taught.

Instructors should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When objectives are added, the instructor should remember to supply the needed information, assignment sheets, job sheets, and criterion test items.

Suggested Activities (Pink Pages)—**Instructor's Edition Only**

The suggested activities component is to assist during the preparation stage of the teaching/learning process. The activities provide suggestions for delivery, application, and evaluation during the instructional process. Teaching suggestions are included for each objective. The instructor should read the suggested activities before teaching the units to allow time to obtain supplemental materials, prepare audiovisual materials, and contact outside resource persons. Duties of the instructor will vary according to the particular unit.

Listed are suggested resources including people and print and non-print media that may be used to teach the unit. Unit references used in the development of each unit are also provided. The instructor can use suggested resources and unit references to supplement her or his knowledge of the subject or to help students with particular interests or objectives in the area covered. Please note that suggested resources and references listed in this publication existed when this publication was written. CIMC assumes no responsibility for providing these materials and cannot ensure the availability of these materials as individual vendors, manufacturers, and publishers may discontinue these products at any time.

Basic Skills (Pink Pages)—**Instructor's Edition Only**

The Basic/Essential Skills Taxonomy, 2nd ed., by Lester M. Snyder, Jr., was used to identify the basic academic skills applied in each objective. *Introduction to Agricultural Products and Processing* uses criterion-referenced testing, which identifies cognitive and psychomotor skills, stated as performance objectives, that students are expected to learn. In *Introduction to Agricultural Products and Processing*, all of the cognitive and psychomotor skills also require student to use academic skills. *The Basic/Essential Skills Taxonomy* provides a means for identifying academic skills students use in meeting the performance objectives.

Handouts (White Pages)—**Instructor's Edition Only**

Handouts provide "nice-to-know" information that is not testable. Handouts provide the instructor with additional information and activities. They may also include items for the gifted or remedial student. The instructor may decide whether to use handouts in teaching the unit.

Information Sheets (Green Pages)

The information sheets provide "must know" content that is essential for meeting the cognitive objectives. The information sheets serve as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. They may also be used for coordination activities and advisory committee meetings.

Students should read the information sheets before the information is discussed in class. Space is provided in margins for students and instructors to add notes that supplement, localize, personalize, or provide motivation for each unit.

The information sheets may include notes, cautions, or warnings. These should be discussed carefully and thoroughly. Notes are short verbal additions to the information or procedural outline that provide nice-to-know and decision-making information. A note may tell the student what to look for or consider at a given step, or may explain when a step may not be applicable. Notes offer guidance that may help the student understand the process and accomplish it more efficiently. Warnings are advisories that alert the student to possible danger to himself or herself or others. Cautions are advisories that alert the student to possible danger to equipment or facilities.

Supplements (Green Pages)

Supplements are in the instructor and student material. Supplements include instructions that could be used for solving problems or reinforcing the enrichment of learning. The information presented in a supplement may consist of tables, charts, written information, forms, or other information students will need in order to complete one or more of the assignments or job sheets. While supplements are not tested over directly, they may be used to assist in meeting the performance objectives.

Transparency Masters (White Pages)

With transparency masters, the students may see as well as hear about the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets or assignment sheets.

Transparencies should be made and placed in the instructor's notebook, where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. Transparencies should be left on the screen only when topics shown are being discussed.

Activity Sheets (Tan Pages)

The purpose of activity sheets is to provide activities which support several objectives. Activity sheets vary greatly in their number and design from unit to unit. Some activity sheets deal with the student's attitudes and beliefs. These may ask rather personal questions and are only intended for each students' personal use. Some activity sheets may require the student to monitor his or her own actions or other personal variables over a period of time. Answer sheets may or may not be included.

Assignment Sheets (Tan Pages)

Assignment sheets are written exercises that have students apply higher order thinking skills. The introduction to the assignment sheet explains how the assignment relates to the subject area and unit objective and may provide instructional information or refer students to another component for such information.

Often, assignment sheets will contain case studies, story problems, or other situations in which the student must analyze the circumstances and determine correct responses. Students may be given assignment sheets as classwork or homework.

Assignment Sheet Answers (Pink Pages)—Instructor's Edition Only

This component is designed to assist the instructor in evaluating student performance on assignment sheets.

Job Sheets (Blue Pages)

Job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychomotor skill. They describe a step-by-step procedure to complete each task or job. Diagrams, photographs, and illustrations assist students in achieving the skill.

The instructor should demonstrate the procedures outlined in each job sheet. Furthermore, the instructor needs to localize the procedure according to the equipment and supplies available in the local situation. Job sheets also show potential employers what skills the student has been exposed to and the performances one might reasonably expect from a student who has had this vocational instruction.

Practical Tests (Yellow Pages)—Instructor's Edition Only

The practical tests assist the instructor in evaluating the psychomotor activities (Job Sheets). The practical tests provide instructors with a valid mechanism for determining a student's level of ability to perform the procedure stated on the job sheet and provide the instructor with a means of evaluating the students' final product.

Written Tests (Yellow Pages)—**Instructor's Edition Only**

This component provides criterion-referenced evaluation of every objective listed in the unit of instruction. All performance objectives, including those in the information sheets, assignment sheets, and job sheets must be evaluated. If objectives have been added, deleted, or modified, appropriate changes should be made on the test.

The tests may be written or oral. It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered.

The acceptable response on a written test, eighty-five (85) percent in most units, may be raised or lowered to fit the topic or student ability level. The percentage applies to the overall score, not to each individual question. The final unit grade should be obtained by combining written test and assignment sheet scores, and by considering how well the student demonstrated the desired skills.

Written Test Answers (Pink Pages)—**Instructor's Edition Only**

This component is designed to assist the instructor in evaluating student performance on written tests.

PAGE NUMBERING

Each publication for the CIMC is assigned a specific abbreviation or will be recognized by the book title. *Introduction to Agricultural Products and Processing* will be referred to by title. Each unit is identified by the unit number in Roman numerals. Each unit in the publication begins with page 1. The page number for an objective sheet in *Introduction to Agricultural Products and Processing* looks like the following:

OBJECTIVE SHEET - Products and Processing
I - 1

METHODS OF DISSEMINATING MATERIAL

Each student should be provided with student materials. Materials may be purchased for less than an instructor can reproduce them, especially when the instructor's time is considered. Student materials contain everything but the suggested activities, handouts, assignment sheet answers, tests, and test answers. Written test packets may be purchased from the Curriculum and Instructional Materials Center. The student should be allowed to take his or her materials home at the end of the year.

TEACHING METHODS

It is a challenge to keep students motivated. Instructors can supplement the objectives by providing the "why," personal experiences, and current information. Preparation for each unit should be determined by how each objective can best be taught. Students should become involved in preparing and planning for each unit.

COMPETENCY PROFILES

A competency profile is available for each CIMC publication. Competency profiles document student performance. The profile contains a list of the specific competencies that a student should achieve before leaving the training program. Profiles should be distributed to students as needed.

CORRECTIONS AND SUGGESTIONS

The Curriculum and instructional Materials Center (CIMC) wants to provide vocational instructors and students with materials that are accurate and effective. Although the CIMC strives to maintain the highest standards of development and production, oversights occasionally do occur. If you find any errors in this or other CIMC publications, or have suggestions for improving their usefulness in vocational programs, please notify the CIMC staff. One easy way of pointing out errors is to make a photocopy of the affected page and to indicate the correction on the copy. Mail this information to the CIMC, where it will be used to correct the publication before the materials are reprinted.

To ensure that the material is updated on a timely basis, notify the CIMC of necessary corrections as soon as possible after discovering the error. Do not assume that someone else will notice the error and inform the CIMC; other users may be making the same assumption. Please send corrections and recommendations for improving this publication to the following address:

Curriculum Development Coordinator
Curriculum and Instructional Materials Center
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OBJECTIVE SHEET

TRENDS IN AGRICULTURAL FOOD PRODUCTS

I

INTRODUCTION

Agricultural food products have undergone tremendous changes in recent years. These changes have been a result of both increased technology and consumer demand. As a result there are many new products on the market and more are continually being introduced. The changes in agricultural food products impact both agricultural producers and consumers.

Agricultural food products play an important role in the United States domestic and international marketplaces. Producers must now react to factors that in earlier days were not major considerations such as the international marketplace and consumer needs and wants.

UNIT OBJECTIVE

After completing this unit, the student will be able to identify current trends in the agricultural food products and processing industry. The student will demonstrate these competencies by completing the assignment sheets and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with food production to their correct definitions.
2. Indicate whether the per capita consumption of a given agricultural product has gone up or down since 1979.
3. Name the percentage of the U.S. population that is involved in the food and fiber system.
4. Describe methods of preserving foods.
5. List factors which affect the locations of food processing facilities.
6. Plot a graph of consumer food trends. (Assignment Sheet 1)
7. Research current export figures. (Assignment Sheet 2)

SUGGESTED ACTIVITIES

TRENDS IN AGRICULTURAL FOOD PRODUCTS

I

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.
- Obtain the latest *Census of Agriculture* for use with Assignment Sheet 2. It is provided by United States Department of Commerce and is available from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. 20402.

DELIVERY

Objective 1

- Go over terminology used in discussing agricultural trends.
- Ask students what they think are some of the major trends in agricultural food products.

Objective 2

- Discuss consumption of agricultural products. Ask students if they have noticed a change in the consumption of different types of products.
- Invite a home economist to speak to the class on how changes in healthy eating habits have affected consumption of some agricultural products.

- Invite a supermarket manager to speak to the class on how many different products are on hand at an average supermarket and how many new products are introduced each year.

Objective 3

- Have students name occupations other than farming and ranching that involve agricultural products.

Objective 4

- Compare methods of home preservation such as canning and smoking with methods used today by large processors.
- Discuss relatively new methods such as freeze drying and dehydrating.

Objective 5

- Discuss factors which affect the locations of food processing facilities.
- If there are any food processing facilities located in your area discuss each factor as it relates to that facility.

APPLICATION

Objective 6

- Use Assignment Sheet 1 to give students practice in analyzing data.

Objective 7

- Use Assignment Sheet 2 to give students practice in researching export figures.
- Research the most current USDA publications for the answers to this assignment sheet.

EVALUATION

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.

- Evaluate students on the assignment sheets if not previously done.
- Reteach and retest if necessary
- Complete appropriate section of competency profiles.

SUGGESTED RESOURCES

Publications

- Obtain current literature on food products from your local county extension agent.

UNIT REFERENCES

- *Agriculture in Oklahoma: The Business of Food and Fiber*, L-218, Oklahoma State University Cooperative Extension Service, Stillwater, Oklahoma, n.d.
- "National Food Review," USDA, Economic Research Service, *1987 Yearbook*, NFR-37.
- "National Food Review," USDA, Economic Research Service, April-June, 1989, Volume 12, Issue 2.
- "National Food Review," USDA, Economic Research Service, October-December, 1988, Volume 11, Issue 4.
- "Food Marketing Review," USDA, Economic Research Service.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd edition, and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Free Enterprise 006	Defines	Economic Terms	
	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 2	Language Arts 132	Comprehends	Information-written	
OBJECTIVE 3	Free Enterprise 061	Describes/ Explains	Business cycles	
OBJECTIVE 4	Free Enterprise 060	Defines	Economic terms	Work force
OBJECTIVE 5	Science 282	Describes/ Explains	Heat	Temperature
	Science 121	Describes/ Explains	Chemical reaction	Inhibitors
OBJECTIVE 6	Language Arts 038	Collects/ Organizes	Information-oral/written	
	Free Enterprise 065	Describes/ Explains	Economic concepts	

OBJECTIVE 7

SKILL AREA/ CODE	VERB	LINK A	LINK B
Mathematics 097	Constructs	Charts/tables/ graphs	
Free Enterprise 061	Describes/ Explains	Business cycles	
Free Enterprise 065	Describes/ Explains	Economic concepts	
Language Arts 278	Uses	Text resources	
Language Arts 136	Comprehends	Information-written	Charts/tables/ graphs

A Comparison of Agricultural Efficiency

	United States	Soviet Union	Brazil	United Kingdom	Mexico	France
Percent of population in production agriculture	2.1%	15.8%	37.4%	2.0%	35.2%	8.2%
Percent of personal income spent for food	12.7%	33.7%	41.0%	17.3%	40.0%	18.5%
Food and fiber trade balance	$24.7 billion	-$15.2 billion	$6.9 billion	-$8.1 billion	-$1.2 billion	$3.6 billion
Minutes worked to earn 1 lb pork	17 min	40 min	31 min	14 min	33 min	18 min
Minutes worked to earn 1 lb bread	3 min	8 min	4 min	2 min	3 min	2 min
Minutes worked to earn 1 doz. eggs	5 min	73 min	14 min	11 min	11 min	8 min

Source: Agriculuture Council of America Education Foundation, Inc. 1984

Courtesy of Oklahoma State University Cooperative Extension Service.

SOME FACTORS THAT AFFECT AGRICULTURAL FOOD PRODUCTS CONSUMPTION

- **Advertising**—The mass media influence food choices through advertising. Advertising makes consumers want and desire certain products.

- **Current social trends**—The emphasis that society places on certain things. For example, the emphasis on health and fitness has impacted eating habits. The need for convenience has also impacted eating habits (microwave dinners, fast food restaurants).

- **Availability**—Whether or not the food is available influences eating habits. Fruits and vegetables that are in season are easily attainable but if out of season may be difficult to find.

- **Cultural factors**—With the diverse make-up of the United States, cultural factors impact upon eating habits. Ethnic foods often end up being popular among many people.

- **Technology**—Technology in both production and processing affect consumption. For example, hybrid products introduce consumers to new products. Technology in food preservation and storage also impacts consumption.

INFORMATION SHEET

TRENDS IN AGRICULTURAL FOOD PRODUCTS

I

OBJECTIVE 1

Match terms associated with food production to their correct definitions.

- **Chain**—A food retailer or food service operator owning 11 or more stores or outlets
- **Convenience store**—A small grocery store, selling a limited variety of foods and nonfood products, typically open extended hours
- **Export**—To send a product to another place
- **Food manufacturing**—Activities that typically use power-driven machines and materials-handling equipment to mechanically or chemically transform raw materials into foods and beverages for human consumption
- **Food service**—The dispensing of prepared meals and snacks intended for on-premise or immediate consumption
- **Food store**—A retail outlet with at least 50 percent of sales in food products intended for off-premise consumption
- **Graph**—A diagram that allows comparison of two or more variables and their relationships at the same time
- **Grocery store**—A food store that sells a variety of food products, including fresh meat, produce, packaged and canned foods, frozen foods, and other processed foods, and nonfood products
- **Gross National Product** (GNP)—The total value of the goods and services produced in a nation during a specified period
- **Import**—To bring a product in from another place
- **Independent**—A food retailer or food service operator owning 10 or fewer stores or outlets
- **Metric ton**—Approximately 1.1 tons
- **Per capita**—By each person

- **Superette**—A grocery store, primarily self-service in operation, selling a wide variety of food and nonfood products with annual sales below $2.5 million (1985 dollars)

- **Supermarket**—A grocery store, primarily self-service in operation, providing a full range of departments, and having at least $2.5 million in annual sales (1985 dollars)

- **Wholesalers**—Operators of firms engaged in the purchase, assembly, transportation, storage, and distribution of grocery products for resale by retailers

OBJECTIVE 2

Indicate whether the per capita consumption of a given agricultural product has gone up or down since 1979.

The eating habits of most Americans have changed significantly during the past 20 years. Some of the reasons are higher food prices, new information on nutrition and technological advances in food production and marketing.

NOTE: The figures below are for changes in per capita consumption of each product from 1979 to 1987.

- Beef—down 4.6 pounds
- Pork—down 4.5 pounds
- Fish—up 2.4 pounds
- Eggs—down 3.5 pounds
- Chicken—up 12.4 pounds
- Whole milk—down 45.7 pounds
- Lowfat milk—up 22 pounds
- Fresh fruits—up 17.8 pounds
- Fresh vegetables—up 7.3 pounds
- Refined sugar—down 26.9 pounds

OBJECTIVE 3 **Name the percentage of the U.S. population that is involved in the food and fiber system.**

The production, processing, transportation and selling of agricultural products, sometimes called food and fiber, is accomplished by a workforce estimated at more than 21 million people, or 18.5 percent of the U.S. population. Many of these people are not directly involved in production agriculture.

EXAMPLES: Truckdrivers, warehousemen, dockworkers and processing plant workers.

- 21 million people or 18.5 percent of the U.S. population are involved in agricultural food production.

  NOTE: This figure is based on 1988 data.

OBJECTIVE 4 **Describe methods of preserving foods.**

- **Heat**—Cooking foods prior to consumption is a method of preservation. However, heat preservation generally refers to canning, blanching or pasteurizing food as a commercial process.
- **Cold**—Refrigerating or freezing foods to preserve them for days, weeks or even years in the case of freezing.
- **Food dehydration and concentration**—Preserving foods by removing all or part of the water from them. In addition to preserving the foods, the product may also be reduced in weight and bulk as an advantage to shipping.
- **Food irradiation**—The use of radiant energy to preserve foods.

  NOTE: The safety of food irradiation is still being studied.
- **Pickling and fermenting**—A preservation process where food products undergo a chemical change. Examples are dill pickles, sour pickles, sour cream, cheeses, and meats.
- **Vacuum packing**—Having much of the air removed before being hermetically sealed.

  NOTE: Hermetically sealed refers to being impermeable to gases and vapors and other external contaminants such as bacteria, yeasts, molds, and dirt.

OBJECTIVE 5

List factors which affect the locations of food processing facilities.

- **Nearness of growing area**—How close is the actual growing and harvesting operation?
- **Location of market**—Where is the product going to be sold?
- **Transportation systems**—What transportation systems are available for transporting products?
- **Availability of raw materials**—Are the raw materials necessary for production readily available?
- **Power**—Is there a sufficient power source?
- **Fuel**—Is there an adequate fuel source nearby?
- **Water**—Is there a sufficient water supply nearby?
- **Waste disposal**—Is there a system for waste disposal?
- **Packaging materials**—Are the necessary resources available for packaging the products?
- **Labor/workforce**—Is there an adequate supply of labor with the needed skills?

CAREERS IN AGRICULTURE

The field of agriculture is exceptionally broad, covering production, processing, distribution, sales, and consumption of hundreds of commodities and products. For purposes of this discussion, it is convenient to define five large categories: production, processing, sales, supporting services and corollary activities.

Production of agricultural commodities at the farm is the fundamental operation on which all other related enterprises are based. Farm commodities typically produced are livestock (cattle, pigs and sheep), milk from dairy cattle, eggs and poultry, meat, grains (corn, barley, rye, wheat, and rice), oil seeds (soybeans, peanuts, and cottonseed), fiber (cotton, wool and mohair), horticultural crops (fruits, vegetables and nuts), and forage crops. In addition, smaller units produce fish, honey, goat milk, seed, etc.

With rare exception, agricultural commodities must go through one or more *processing* procedures before they are in final forms for consumption. Eggs must be washed, graded and packaged; milk must be pasteurized and homogenized, fruits and vegetables must be cleaned, sorted, canned, and packaged, etc. Oil seeds must be fractionated into oil and meal, and cotton must be separated into seed and fiber, and each must be further processed. Feed and food grains must be converted into different forms for consumption by animals or humans.

Following processing, agricultural products must be distributed and *sold* to intermediate or final consumers. Supermarkets and other retail outlets account for most of food sales, while feed mills and feed stores sell much of the livestock and poultry feed. A substantial portion of our food and feed grains and our cotton fiber go to international markets, and we import, for processing and resale, considerable agricultural commodities from foreign sources.

Production, processing and sale of agricultural commodities require a vast array of *supporting services.* Production machinery, fertilizers, insecticides, processing equipment, storage units, slaughter plants, distribution centers, animal feed supplements, and veterinary supplies are but a few of the many enterprises necessary in the agricultural chain of events.

In addition to the foregoing categories, there are many *corollary activities* required by a successful national agricultural system. Farm credit, banking and financial services, transportation, adequate road and rail systems, regulatory services, government agencies and educational programs (teaching, research and extension) are all vital to a viable, sustained agriculture.

AGRICULTURAL CAREER FIELDS

Production of Agricultural Commodities

- Agronomic crops
  - Wheat
  - Cotton
  - Sorghum
  - Corn
  - Small grains
  - Oilseeds
- Horticultural crops
  - Vegetables
  - Fruits
  - Nuts
  - Flowers
- Forage Crops
  - Pastures
  - Hays
  - Silages
- Livestock
  - Beef cattle (feeder calves and feedlot)
  - Dairy cattle
  - Swine

  - Sheep
  - Goats
  - Fish
  - Bees
  - Poultry (broilers and eggs)

Processing of Agricultural Commodities

- Food
  - Horticultural products
  - Meats and by-products
  - Milk and milk products
  - Poultry
- Fiber
  - Cotton
  - Wool
  - Mohair
  - Synthetic blends
- Milling
  - Flour
  - Feed
  - Oil and oil meals

Sales

- Raw farm commodities
- Processed products
- Supplies and equipment needed for production and processing

Supporting Services

- Manufacture of machinery for production and processing
- Production inputs
  - Fertilizers
  - Farm chemicals
  - Feeds

  - Seeds
  - Veterinary

Corollary Activities

- Finance
- Transportation
- Government
  - Regulatory agencies
  - Marketing
  - Policy
  - Reporting systems
  - International activities
- Education
  - Research
  - Extension
  - Teaching
- Communication

INTERNATIONAL AGRICULTURAL TRADE

International agricultural trade is composed of exports and imports. Exports are commodities the United States sells to other countries and imports are commodities other countries sell to the United States. The United States agricultural sector is deeply integrated into the international marketplace. Many aspects of United States agriculture are affected either directly or indirectly by the international agricultural trade.

The United States is one of the world's largest net exporters of agricultural commodities. Grains, soybeans, and livestock products are some of the important exports. The United States conducts agricultural trade with many countries. The amount of trade done with a country depends on the trade agreements with that country, and the condition of the international marketplace. The United States also imports agricultural commodities such as coffee, wool, fruits and vegetables, and timber.

The agricultural sector has consistently produced a positive trade balance, meaning that more commodities were exported than imported. Some of the countries that are important export customers are Japan, USSR, Netherlands, Mexico, Canada, and South Korea. Some of the major suppliers of agricultural commodities to the U.S. are Brazil, Canada, and Mexico.

Because of the importance of international trade to agriculture, people employed in all aspects of agriculture should be aware of the international marketplace and how it may affect their business.

Table 680.—Per capita consumption of major food commodities (retail weight), United States, 1979–87 [1]

Commodity	1979	1980	1981	1982	1983	1984	1985	1986	1987 [2]
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Meats [3]	144.7	147.4	145.0	138.4	143.2	142.8	144.1	140.2	135.4
Beef	78.0	76.4	77.1	76.8	78.2	78.1	78.8	78.4	73.4
Veal	1.7	1.5	1.6	1.7	1.6	1.8	1.8	1.9	1.5
Lamb and mutton	1.3	1.4	1.4	1.5	1.5	1.5	1.4	1.4	1.3
Pork	63.7	68.1	64.9	58.5	61.9	61.5	62.0	58.6	59.2
Fish (edible weight)	13.0	12.8	12.9	12.3	13.1	13.7	14.4	14.7	15.4
Canned	4.8	4.5	4.8	4.3	4.8	4.9	5.1	5.4	5.1
Fresh and frozen	7.8	8.0	7.8	7.7	8.0	8.5	9.0	9.0	10.0
Cured	.4	.3	.3	.3	.3	.3	.3	.3	.3
Poultry products:									
Eggs	35.1	34.4	33.5	33.5	33.0	32.9	32.2	31.7	31.6
Chicken (ready-to-cook)	50.3	49.8	51.3	52.7	53.4	55.2	57.6	58.7	62.7
Turkey (ready-to-cook)	9.9	10.5	10.7	10.8	11.2	11.3	12.1	13.3	15.1
Dairy products:									
Total dairy products (milk equivalent)	548.0	543.4	540.9	555.5	572.4	581.2	592.7	590.6	598.2
Fluid milk and cream (product weight)	251.7	246.4	240.6	235.7	236.1	236.0	238.5	237.5	235.7
Plain and flavored whole milk	155.6	147.0	139.6	134.1	130.8	126.6	122.7	115.4	109.9
Lowfat milk, total	88.1	91.2	92.9	93.1	95.9	99.1	104.6	110.4	113.6
Lowfat milk (2% and 1% fat)	67.2	70.2	72.0	72.8	74.2	77.3	81.7	86.6	89.2
Skim milk	11.7	11.7	11.2	10.6	10.6	11.5	12.5	13.3	14.0
Buttermilk	4.2	4.1	4.0	4.1	4.3	4.4	4.4	4.2	4.0
Flavored drink	5.0	5.3	5.6	5.5	6.8	6.0	6.0	6.3	6.3
Cheese (excluding cottage)	17.2	17.5	18.2	19.9	20.5	21.4	22.5	23.0	24.0
American	9.6	9.6	10.2	11.3	11.6	11.8	12.1	12.1	12.5
Cheddar	6.9	6.9	7.0	8.7	9.1	9.5	9.7	9.7	10.6
Italian	4.2	4.4	4.5	4.8	5.3	5.8	6.4	7.0	7.6
Mozzarella	2.8	3.0	3.0	3.3	3.7	4.0	4.6	5.2	5.6
Cottage cheese	4.5	4.5	4.3	4.2	4.1	4.1	4.1	4.1	3.9
Condensed and evaporated milk:									
Whole milk	4.1	3.8	4.0	4.0	3.8	3.7	3.7	3.6	3.8
Skim milk	3.3	3.3	3.2	3.0	3.2	3.7	3.8	4.3	4.2
Ice cream (product weight)	17.3	17.5	17.4	17.6	18.0	18.1	18.1	18.4	18.3
Fats and oils—Total fat content	56.4	57.2	57.7	58.2	60.0	58.6	64.0	64.1	62.7
Butter (actual weight)	4.5	4.5	4.2	4.3	4.9	4.9	4.9	4.6	4.6
Margarine (actual weight)	11.2	11.3	11.1	11.0	10.4	10.4	10.8	11.4	10.5
Shortening	18.4	18.2	18.5	18.6	18.5	21.2	22.8	22.0	21.3
Lard (direct use)	2.5	2.6	2.5	2.5	2.1	2.1	1.8	1.7	1.8
Edible tallow (direct use)	.4	1.1	1.0	1.3	2.1	1.7	1.9	1.8	1.0
Salad and cooking oils	20.8	21.2	21.8	21.8	23.5	19.8	23.5	24.1	25.2
Selected fresh fruits	80.8	86.4	83.1	83.7	88.4	87.8	86.3	93.2	98.6
Citrus	23.9	27.9	24.1	23.9	28.3	23.2	22.6	26.6	27.2
Apples	16.8	18.3	16.1	17.1	17.6	17.6	16.6	17.3	20.3
Other noncitrus	40.2	40.2	42.9	42.7	42.4	47.0	47.1	49.3	51.2
Selected fresh vegetables [4]	71.3	72.8	71.5	74.2	74.7	78.8	78.8	79.9	78.6
Selected vegetables for processing [5]	106.4	105.2	100.2	98.5	100.4	108.6	104.4	103.4	104.2
Tomatoes for processing [5] [6]	64.3	63.6	59.3	60.1	60.8	68.4	63.1	63.4	64.6
Cucumbers for pickling [5]	5.9	5.6	5.7	5.7	5.8	5.8	5.8	5.3	5.1
Other vegetables for canning [5] [7]	21.0	21.4	20.6	19.1	19.1	17.0	18.6	18.9	17.4
Vegetables for freezing [5] [8]	15.1	14.6	14.6	13.6	14.8	17.4	16.9	15.8	17.1
White potatoes:									
Fresh	47.6	49.0	43.8	44.8	47.9	46.8	44.7	47.6	45.1
Frozen	20.7	17.9	19.1	20.0	19.1	20.7	22.0	22.0	23.2
Chips and shoestrings	4.1	4.1	4.1	4.2	4.4	4.4	4.3	4.5	4.3
Canned	1.3	1.2	1.1	1.2	1.2	1.1	1.2	1.1	1.1
Dehydrated	1.5	1.3	1.5	1.4	1.4	1.4	1.6	1.5	1.5
Grains:									
Wheat flour [9]	117.2	116.8	115.8	116.7	117.4	118.1	123.3	123.6	128.0
Rice	9.4	9.4	11.0	11.8	9.7	8.6	9.1	11.6	13.4
Pasta	10.2	10.0	10.0	9.9	10.5	11.3	12.9	14.4	17.1
Breakfast cereals	12.9	12.9	13.0	13.1	13.4	14.0	14.4	14.8	15.2
Other:									
Coffee	8.6	7.7	7.7	7.6	7.6	7.6	7.6	7.8	7.6
Cocoa (chocolate liquor equivalent)	2.7	2.7	2.9	3.0	3.2	3.6	3.7	3.8	3.9
Peanuts (shelled)	5.9	4.8	5.5	5.9	5.9	6.0	6.3	6.4	6.4
Sugar (refined) [10]	89.3	83.6	79.3	73.6	70.9	67.3	63.4	60.8	62.4
Corn sweeteners (dry weight) [11]	36.3	40.2	44.5	48.1	52.1	57.8	66.5	67.1	68.8
Soft drinks (gallons)	27.0	27.1	27.1	26.9	28.9	27.2	29.1	30.3	n.a.

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[1] Quantity in pounds, retail weight unless otherwise shown. Data on calendar year basis except fresh citrus fruits, peanuts and rice which are on a crop-year basis. [2] Preliminary. [3] Total may not add due to rounding. [4] Includes asparagus, broccoli, carrots, cauliflower, celery, sweet corn, lettuce, onions and tomatoes. [5] Fresh equivalent. [6] Used in such processed products as ketchup, canned tomatoes, tomato paste, and tomato puree. [7] Includes asparagus, carrots green peas, snap beans, and sweet corn. [8] Includes asparagus, broccoli, carrots, cauliflower, green peas, snap beans, and sweet corn. [9] White, whole wheat, semolina, and durum flour. [10] Includes small amount of refined sugar contained in imported blends and mixtures, including sucrose-dextrose blends, sugar-sweetened tea mixes, and flavored syrups in consumer size containers. [11] High fructose, glucose, and dextrose. n.a. not available.

Economic Research Service. Historical consumption and supply-utilization data for food may be found in Food Consumption, Prices, and Expenditures, 1986–87, ERS, USDA, forthcoming.

ACTIVITY SHEET 1

TRENDS IN AGRICULTURAL FOOD PRODUCTS

INTRODUCTION

Foods are processed or changed in some way for a number of reasons. While some foods are eaten raw, such as fruits and vegetables, others may be ground, chopped, seasoned, mixed with other ingredients and appear quite different from the original raw material.

DIRECTIONS

Go to the kitchen in your home and look in the cabinets and the refrigerator.

- Find a food that can be eaten raw.
- Find a food that has undergone some processing but is still identifiable.
- Find a food that you would not be able to guess the raw material without looking at the label.

ACTIVITY SHEET 2

TRENDS IN AGRICULTURAL FOOD PRODUCTS

INTRODUCTION

Often there are big differences in the prices of the same product in grocery stores. These differences may be because of the way the product is offered for sale, the way it is packaged, the quality of the raw materials or whether or not some of the preparation was done by the processor.

DIRECTIONS

Take a pencil, notebook and a pocket calculator to the grocery store. Record the weight of the following products and their cost. Use the calculator to divide the weight of the products in ounces into the cost of the product to determine the price per ounce. In some supermarkets this information is marked on the shelf below the products and will be listed on the label of most meat products. Remember, some products will be cheaper per ounce but you will be paying for materials that you cannot eat, such as bone, fat and excess liquid.

- Fresh whole chickens
  price__________divided by weight__________equals price per ounce__________
- Boneless chicken breasts
  price__________divided by weight__________equals price per ounce__________
- Canned chicken chunks
  price__________divided by weight__________equals price per ounce__________
- Raw apples
  price__________divided by weight__________equals price per ounce__________
- "Name brand" applesauce
  price__________divided by weight__________equals price per ounce__________
- "Economy brand" applesauce
  price__________divided by weight__________equals price per ounce__________
- Frozen corn on the cob
  price__________divided by weight__________equals price per ounce__________
- Frozen whole kernel corn
  price__________divided by weight__________equals price per ounce__________

- "Name brand" canned corn

  price_________divided by weight_________equals price per ounce_________
- "Economy brand" canned corn

  price_________divided by weight_________equals price per ounce_________
- Fresh tomatoes

  price_________divided by weight_________equals price per ounce_________
- Canned tomatoes

  price_________divided by weight_________equals price per ounce_________
- "Economy brand" popcorn

  price_________divided by weight_________equals price per ounce_________
- "Name brand popcorn"

  price_________divided by weight_________equals price per ounce_________
- Microwave popcorn

  price_________divided by weight_________equals price per ounce_________

ACTIVITY SHEET 3 — TRENDS IN AGRICULTURAL FOOD PRODUCTS

DIRECTIONS Go to the grocery store and read the labels on different food products. Find examples of the following preservation and processing methods.

Canned

____

____

____

Preserved

____

____

____

Dehydrated

____

____

____

Frozen

____

____

____

Pickled

____

____

____

Freeze dried

Concentrated

ASSIGNMENT SHEET 1

TRENDS IN AGRICULTURAL FOOD PRODUCTS

NAME ______________________________ SCORE ________

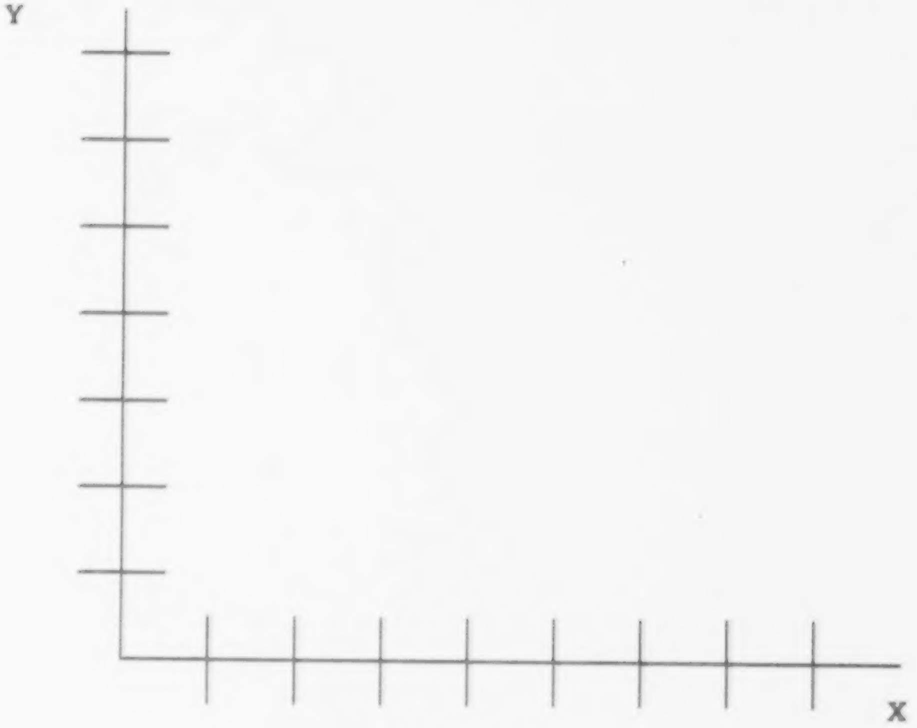
OBJECTIVE 6 **Plot a graph of consumer food trends.**

INTRODUCTION A graph is a diagram that allows comparison of two or more variables and their relationships at the same time. We will plot the per capita consumption of citrus products in the United States from 1979 to 1987.

DIRECTIONS Look at the graph model on the following page. The horizontal line on a graph is called the x-axis. The vertical line is called the y-axis. Label the x-axis beginning where it meets the y-axis with the years beginning with 1979 and continuing through 1987. Label the y-axis, beginning where it meets the x-axis, with numbers of pounds beginning with 22 and continuing through 29. Using the table in Supplement 3, find the citrus total for 1979 (23.9 pounds). On the graph, follow the line up from 1979 and make a dot where 23.9 is. You do not have to be exact, just as close as you can. Now, on the table, look under 1980 and find that value (27.9 pounds). On the graph, go up from 1980 and make a mark at 27.9. Continue until you have finished at 1987. Now, beginning at the first dot, draw straight lines between them until they are all connected. After you have completed the graph, answer the questions below.

1. What year between 1979 and 1987 was citrus consumption the lowest? ______________________________
2. The highest? ______________________________
3. Between what two years was the greatest drop in consumption? ______________________________

Graph of Consumer Food Trends



ASSIGNMENT SHEET 2

TRENDS IN AGRICULTURAL FOOD PRODUCTS

NAME ______________________________ SCORE _______

OBJECTIVE 7 **Research current export figures.**

INTRODUCTION International trade plays an important role in United States agriculture. Agricultural exports account for a significant percentage of United States agricultural production.

Part I

DIRECTIONS To understand the impact of agricultural exports, research the commodities listed below and determine what countries are the biggest purchasers of those products, and the dollar amount they spend.

Live cattle ____

Meats and products ______________________________________

Wheat ____

Dairy products ____

Poultry and poultry products _____________________________

Cotton ____

Soybeans ____

Part II

Find the top ten U.S. agricultural export commodities, by value, for the most current year available.

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

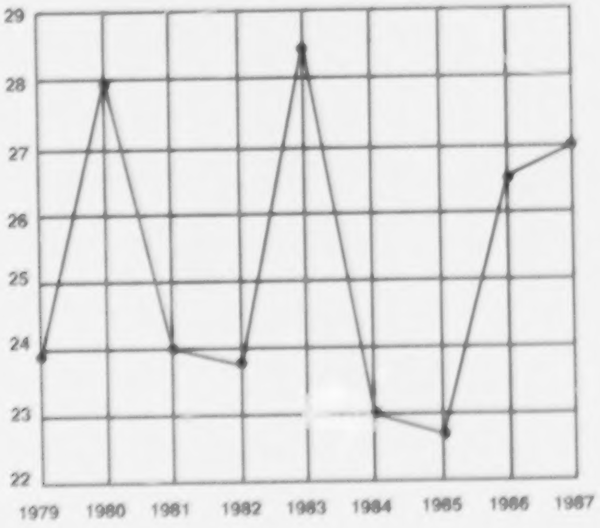
7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

ASSIGNMENT SHEET 1



1. 1985
2. 1983
3. 1983 and 1984

ASSIGNMENT SHEET 2

Part I

Make sure student has researched data and put in the correct information.

Part II

Make sure student has researched data and put in the correct information.

WRITTEN TEST

TRENDS IN AGRICULTURAL FOOD PRODUCTS

I

NAME ______________________ SCORE ______

OBJECTIVE 1

Match terms associated with food production to their correct definitions. Write the correct letters in the blanks.

____ 1. A food retailer or food service operator owning 11 or more stores or outlets

____ 2. Operators of firms engaged in the purchase, assembly, transportation, storage, and distribution of grocery products for resale by retailers

____ 3. A grocery store, primarily self-service in operation, providing a full range of departments, and having at least $2.5 million in annual sales (1985 dollars)

____ 4. A small grocery store, selling a limited variety of foods and nonfood products, typically open extended hours.

____ 5. A grocery store, primarily self-service in operation, selling a wide variety of food and nonfood products with annual sales below $2.5 million (1985 dollars)

____ 6. Activities that typically use power-driven machines and materials-handling equipment to mechanically or chemically transform raw materials into foods and beverages for human consumption

____ 7. To send a product to another place

a. Food store
b. Chain
c. Convenience store
d. Mini-mart
e. Per person
f. Gross National Product
g. Supermarket
h. Graph
i. Wholesalers
j. Grocery store
k. Chart
l. Independent
m. Food service
n. Export
o. Food manufacturing
p. Superette
q. Owner
r. Per capita
s. Trade balance

____8. By each person

____9. The dispensing of prepared meals and snacks intended for on-premise or immediate consumption

____10. A food retailer or food service operator owning 10 or fewer stores or outlets

____11. A retail outlet with at least 50 percent of sales in food products intended for off-premise consumption

____12. A diagram that allows comparison of two or more variables and their relationships at the same time

____13. The total value of the goods and services produced in a nation during a specified period

____14. A food store that sells a variety of food products, including fresh meat, produce, packaged and canned foods, frozen foods, and other processed foods, and nonfood products

____15. Approximately 1.1 tons

____16. To bring a product in from another place

t. Retailers

u. Metric ton

v. Import

OBJECTIVE 2

Indicate whether the per capita consumption of a given agricultural product has gone up or down since 1979. Write the words up or down in the blank.

____________1. Whole milk

____________2. Fresh fruit

____________3. Beef

____________4. Fish

____________5. Eggs

____________6. Refined sugar

__________ 7. Pork

__________ 8. Chicken

__________ 9. Lowfat milk

__________ 10. Fresh vegetables

OBJECTIVE 3

Name the percentage of the U.S. population that is involved in the food and fiber system. Write the answer in the space provided.

OBJECTIVE 4

Describe methods of preserving foods. Describe four methods for preserving foods in the space provided.

OBJECTIVE 5

List factors which affect the locations of food processing facilities. Write five factors in the space below.

NOTICE The following assignment sheets are not part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 6 **Plot a graph of consumer food trends.** SCORE ________

OBJECTIVE 7 **Research current export figures.** SCORE ________

WRITTEN TEST ANSWERS

TRENDS IN AGRICULTURAL FOOD PRODUCTS

I

OBJECTIVE 1

1. b
2. i
3. g
4. c
5. p
6. o
7. n
8. r
9. m
10. l
11. a
12. h
13. f
14. j
15. u
16. v

OBJECTIVE 2

1. down
2. up
3. down
4. up
5. down
6. down
7. down
8. up
9. up
10. up

OBJECTIVE 3

18.5 percent

OBJECTIVE 4

Answer may include any four of the following:

- Heat—Cooking foods prior to consumption is a method of preservation. However, heat preservation generally refers to canning, blanching or pasteurizing food as a commercial process.
- Cold—Refrigerating or freezing foods to preserve them for days, weeks or even years in the case of freezing.
- Food dehydration and concentration—Preserving foods by removing all or part of the water from them. In addition to preserving the foods, the product may also be reduced in weight and bulk as an advantage to shipping.

- Food irradiation—The use of radiant energy to preserve foods.
- Pickling and fermenting—A preservation process where food products undergo a chemical change. Examples are dill pickles, sour pickles, sour cream, cheeses, and meats.
- Vacuum packing—Having much of the air removed before being hermetically sealed.

OBJECTIVE 5 Answer may include any five of the following:

- Nearness of growing area operation
- Location of market
- Transportation systems
- Availability of raw materials
- Power
- Fuel
- Water
- Waste disposal
- Packaging materials
- Labor/workforce

OBJECTIVE 6 Refer to answers to Assignment Sheet 1.

OBJECTIVE 7 Refer to answers to Assignment Sheet 2.

OBJECTIVE SHEET

DEMONSTRATE GENERAL SAFETY PRACTICES

II

INTRODUCTION

Safety is one of the most important aspects of all industries. Since safety is basically an attitude, it can easily become a part of your everyday life at home and on the job. Injuries can be costly to an organization, but you are the one who suffers most if hurt in an accident because of an unsafe attitude.

UNIT OBJECTIVE

After completing this unit, the student should be able to state basic safety practices, correct safety hazards and operate a fire extinguisher. The student will demonstrate these competencies by completing the assignment sheets, job sheet, and written test with a minimum of 100 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with general safety practices to their correct definitions.
2. State the major causes of accidents.
3. State jobsite safety practices.
4. List types of common job-related injuries.
5. Complete statements about first-aid kits.
6. Match the basic classes of fires with examples of each class.
7. Match types of fire extinguishers to the class(es) of fires on which each is used.
8. State the information to be given when reporting a fire.
9. State electrical safety measures.
10. State chemical safety precautions.
11. List common protective equipment used in processing agricultural products.
12. Complete an accident report. (Assignment Sheet 1)
13. Correct safety hazards. (Assignment Sheet 2)

14. Demonstrate the ability to operate a fire extinguisher. (Job Sheet 1)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

DELIVERY

Objective 1

- Write the terms on a chalkboard and poll class for definitions.

- Review terms and definitions.

  NOTE: Be sure to emphasize the notes under the definitions.

- Discuss the importance of safety for all persons regardless of occupation.

Objective 2

- Ask students about accidents they have experienced and what caused them.

- Discuss your own experiences with accidents.

- Copy and distribute Handout 1 — *Safety Pledge*, if desired. Have students read the pledge and sign it, if appropriate.

Objective 3

- Use the Information Sheet to discuss jobsite safety practices.
- Discuss safety rules in your work area.
- Invite an OSHA representative, a safety officer or other experienced person to talk about the kinds of accidents that can happen on the job.
- Introduce students to the Williams-Steiger Occupational Safety and Health Act (OSHA). It became law on April 28, 1971. The law was enacted to:

  > "...assure so far as possible every working man and woman in the Nation, safe and healthful working conditions and to preserve our human resources..."

  The law recognizes employee safety and health as public problems rather than private or individual concerns.

  The OSHA standards contain four major categories: general industry, construction, maritime, and agriculture. Implementation is to be conducted in the following six ways:

  1. Encouraging employers and employees to reduce hazards in the workplace and start to improve existing safety and health programs.
  2. Establishing employer and employee responsibilities.
  3. Authorizing OSHA to set mandatory job safety and health standards.
  4. Providing an effective enforcement program.
  5. Encouraging the states to assume the fullest responsibility for administering and enforcing their own occupational safety and health programs that are to be at least as effective as the federal program.
  6. Providing for reporting procedures on job injuries, illness, and fatalities.

- Discuss OSHA requirements for your school.

Objective 4

- Copy and distribute Handout 2 - *How to Lift Safely*, if desired.

- Poll class for other types of injuries.

- Discuss how the types of injuries occur.

- Discuss how the injuries can be prevented.

- Show one or more of the following videos:

  - *Slips and Falls*
  - *Minimizing Back Strain on the Job*
  - *Preventing Back Injuries*
  - *Hand Safety*
  - *The Future is in Your Hands*
  - *Eye Safety*

Objective 5

- Stress the necessity of learning first aid.

- Provide students with the number for your local Red Cross Office.

- Encourage students to take a course in CPR (Cardio-Pulmonary Resuscitation) to learn what to do in case of a heart attack.

- Review procedures for what to do in case of an accident in your school and in your community.

- Have students inventory the first-aid kit in your department.

- Visit another shop in the school and have students locate the fire extinguishers and first-aid kit.

Objective 6

- Review Handout 3 - Chemical Chain Reaction. Copy and distribute to students, if desired.

- Show and discuss Transparency Masters 1 through 4 to explain the fire triangle.

NOTE: Before you explain the types of fires, it is important that the students understand the fire triangle.

- Use Transparency Masters 5 and 6 to explain the basic classes of fires.
- Have a fire fighter come into the class to discuss the types of fires and extinguishers.

Objective 7

- Use Transparency Masters 7 and 8 to discuss the types of fire extinguishers to be used on various fires.
- Show one or more of the following videos:
  - *Portable Fire Extinguishers*
  - *Safety On the Job: Fire Extinguishers*

Objective 8

- Have students practice making phone calls to report a fire.

Objective 9

- Show the videos *Electrical Safety* and *The Path of Least Resistance*.
- Have a local electrician visit with the class regarding electrical safety.

Objective 10

- Review chemical safety practices with students.
- Compare processing plant chemical safety with other agricultural chemical safety practices.
- Invite someone from a processing plant to discuss the use of chemicals in the plant.
- Invite three local agricultural products processors to discuss how they determine safety hazards in their plants.

Objective 11

- Bring several examples of protective equipment/clothing to class and pass them around the room.

- Discuss how each item protects the wearer/user from an accident.

- Poll class for additional items that are used in processing plants to protect workers.

- Use Supplement 1.

APPLICATION

Objective 12

- Use Assignment Sheet 1 to help students understand the consequences of carelessness and hazards in the workplace.

Objective 13

- Use Assignment Sheet 2 to help students make a correlation between the objectives of this unit and the "real life" situations.

- Create a series of hazards in an area of your classroom or shop (or both).

- Have each student walk through the area and identify hazards and how each should be properly corrected.

  NOTE: Do not allow the other students to sneak in or compare notes before their turn through the hazardous area. Make the students who have completed their tour go to an area away from the remaining students.

Objective 14

- Use Job Sheet 1 to give students hands-on experience in using fire extinguishers. Obtain clearance through your administration to set a small fire outside in a waste basket to allow students to actually extinguish a full fire using a fire extinguisher.

  WARNING: Be sure that you have permission prior to this objective.

- If you cannot obtain permission, use a full fire extinguisher and allow each student to demonstrate the proper use by spraying the ground with the extinguisher.

- Have the students describe the action rather than exhaust the extinguisher, if desired.

EVALUATION

Practical Test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Give practical test.
- Reteach and retest if necessary.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Audiovisual Materials

- *Electrical Safety*, 1/2" video, 29 minutes, Tel-A-Train, Inc., 1988. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *Emergency Priorities*, 1/2" video, 24 minutes, Tel-A-Train, Inc., 1987. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *Eye Safety*, 1/2" video, 20 minutes, Tel-A-Train, Inc., 1985. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *The Future is in Your Hands*, 1/2" video, 13 minutes, Agency for Instructional Technology, 1986. Available from Agency for Instructional Technology, Box A, Bloomington, IN 47402-0120.

- *Hand Safety*, 1/2" video, 18 minutes, Tel-A-Train, Inc., 1987. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *Minimizing Back Strain on the Job*, 1/2" video, 25 minutes, Tel-A-Train, Inc., 1984. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *The Path of Least Resistance*, 1/2" video, 15 minutes, Agency for Instructional Technology, 1986. Available from Agency for Instructional Technology, Box A, Bloomington, IN 47402-0120.
- *Portable Fire Extinguishers*, 1/2" video, 26 minutes, Tel-A-Train, Inc., 1984. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *Preventing Back Injuries*, 1/2" video, 24 minutes, Aims Instructional Media, 1987. Available from Aims Instructional Media, 6901 Woodly Ave., Van Nuys, CA 91406-4878.
- *Recognizing Sudden Illness*, 1/2" video, 14 minutes, Tel-A-Train, Inc., 1988. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *Safety On the Job: Fire Extinguishers*, 1/2" video, 23 minutes, Aims Instructional Media, 1988. Available from Aims Instructional Media, 6901 Woodly Ave., Van Nuys, CA 91406-4878.
- *Slips and Falls*, 1/2" video, 24 minutes, Tel-A-Train, Inc., 1984. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.
- *Treating Common Injuries*, 1/2" video, 16 minutes, Tel-A-Train, Inc., 1988. Available from Tel-A-Train, Inc., P.O. Box 4752, 309 N. Market St., Chattanooga, TN 37405.

NOTE: The above videos are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these videos from the Oklahoma Department of Vocational and Technical Education, Resource Center, ATTN: Instructional Media Specialist, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074-4364, phone 800-522-5810. Out-of-state teachers must order from the addresses listed with each film.

UNIT REFERENCES

- *Accident Prevention Manual for Industrial Operations, Engineering and Technology*, National Safety Council, Chicago, Illinois, 1988.
- *Accident Prevention Manual for Industrial Operations, Administration and Programs*, National Safety Council, Chicago, Illinois, 1988.
- Firenze, Robert J. and James B. Walters, *Safety & Health for Industrial/ Vocational Education*, United States Department of Health and Human Services, Washington, D.C., 1981.
- *Introduction to Automotive Services*, Oklahoma Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, Stillwater, Oklahoma, 1989.
- *Pennsylvania Industrial Arts Safety Guide*, 2nd ed., Pennsylvania Department of Education, 1981.
- *Safety Education Handbook*, Kansas State Department of Education, Wichita, Kansas.
- *Safety on the Job*, Oklahoma Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, Stillwater, Oklahoma, 1989.
- *Standard First Aid and Personal Safety*, 2nd ed., American Red Cross, Doubleday & Company, Inc., Garden, City, New York, 1979.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 2	Language Arts 134	Comprehends	Information-written	Cause/effect relationships
	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
OBJECTIVE 3	Language Arts 132	Comprehends	Information-written	
	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
OBJECTIVE 4	Language Arts 038	Collects/ Organizes	Information-written	
	Language Arts 132	Comprehends	Information-written	
	Science 283	Describes/ Explains	Human/animal	
OBJECTIVE 5	Language Arts 139	Comprehends	Information-written	Context
OBJECTIVE 6	Science 466	Identifies	Definitions	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 7	Science 466	Identifies	Definitions	
	Science 476	Identifies	Matter	Uses
	Science 037	Applies/Uses	Classification systems	
OBJECTIVE 8	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
	Language Arts 132	Comprehends	Information-written	
OBJECTIVE 9	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
	Language Arts 132	Comprehends	Information-written	Information supplying
OBJECTIVE 10	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
	Language Arts 132	Comprehends	Information-written	
OBJECTIVE 11	Language Arts 132	Comprehends	Information-written	
	Language Arts 038	Collects/ Organizes	Information-written	
OBJECTIVE 12	Language Arts 058	Composes/ Edits	Forms/ Documents	
	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
	Language Arts 075	Composes/ Edits	Paragraphs	Cause/effect relationships

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 13	Science 045	Applies/Uses	Scientific methods	Analysis-qualitative/ quantitative
	Science 047	Applies/Uses	Scientific methods	Observation-direct/indirect
	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
OBJECTIVE 14	Language Arts 035	Attends	Directions/task	
	Science 471	Identifies	Matter	

SAFETY PLEDGE

It is understood that each student/employee will be given proper instruction in the use of the equipment and in the correct safety procedures concerning the equipment before she or he will be allowed to operate it. The student/employee must assume responsibility for following safe practices. We, therefore, ask that the student/employee subscribe to the following safety pledge:

I will follow all safety rules.

I will never use a machine without first having permission from my instructor or supervisor.

I will not ask permission to use a particular machine unless I have been instructed in its use and have scored 100 percent on the safety test for that machine.

I will report immediately any accident or injury, no matter how minor, to my instructor or supervisor.

Student's/employee's signature Date

Manager's signature Date

Supervisor's or instructor's signature Date

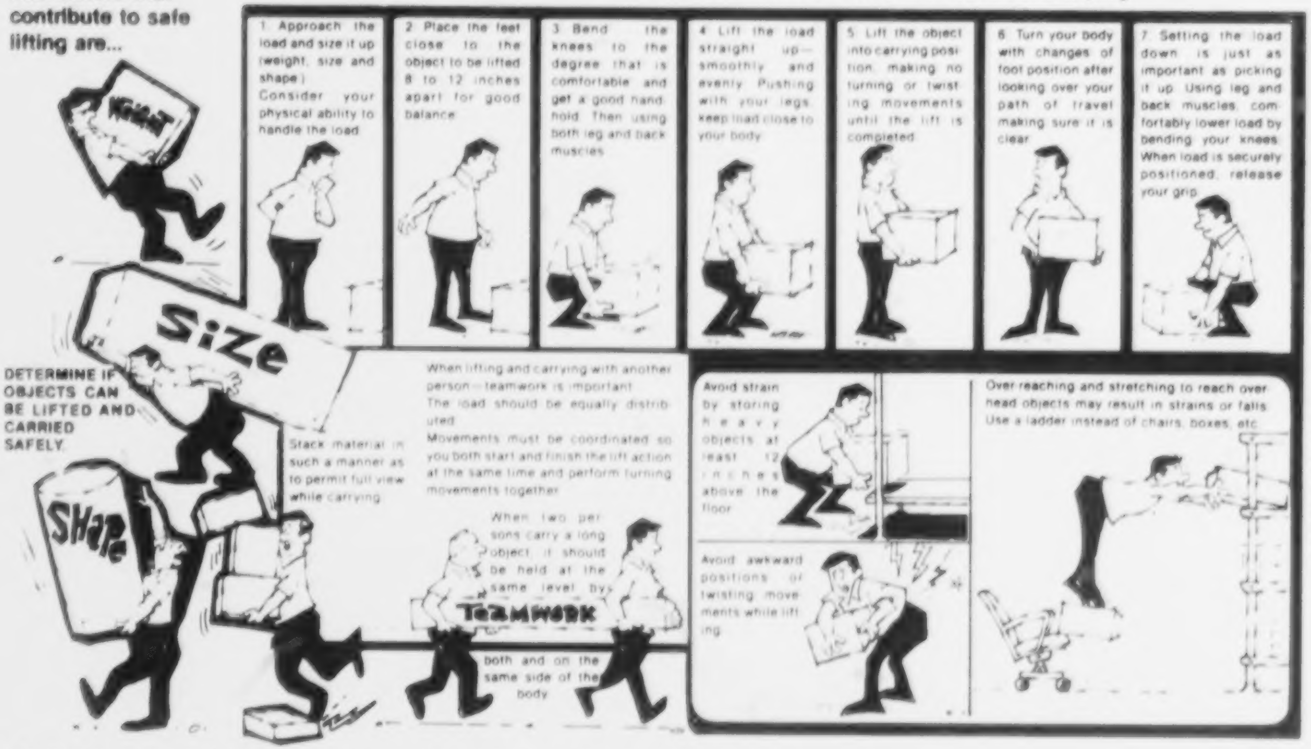
Parent's or guardian's signature Date

(Parental consent is necessary if the student/employee is under 18.)

HOW TO LIFT SAFELY

How to Lift Safely

The following safe practices should be observed in order to avoid injury.



The factors that contribute to safe lifting are...

DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY.

1. Approach the load and size it up (weight, size and shape.) Consider your physical ability to handle the load.

2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.

3. Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles.

4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.

5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.

7. Setting the load down is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

Stack material in such a manner as to permit full view while carrying.

When lifting and carrying with another person—teamwork is important. The load should be equally distributed. Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.

Avoid strain by storing heavy objects at least 12 inches above the floor.

Avoid awkward positions or twisting movements while lifting.

Over reaching and stretching to reach overhead objects may result in strains or falls. Use a ladder instead of chairs, boxes, etc.

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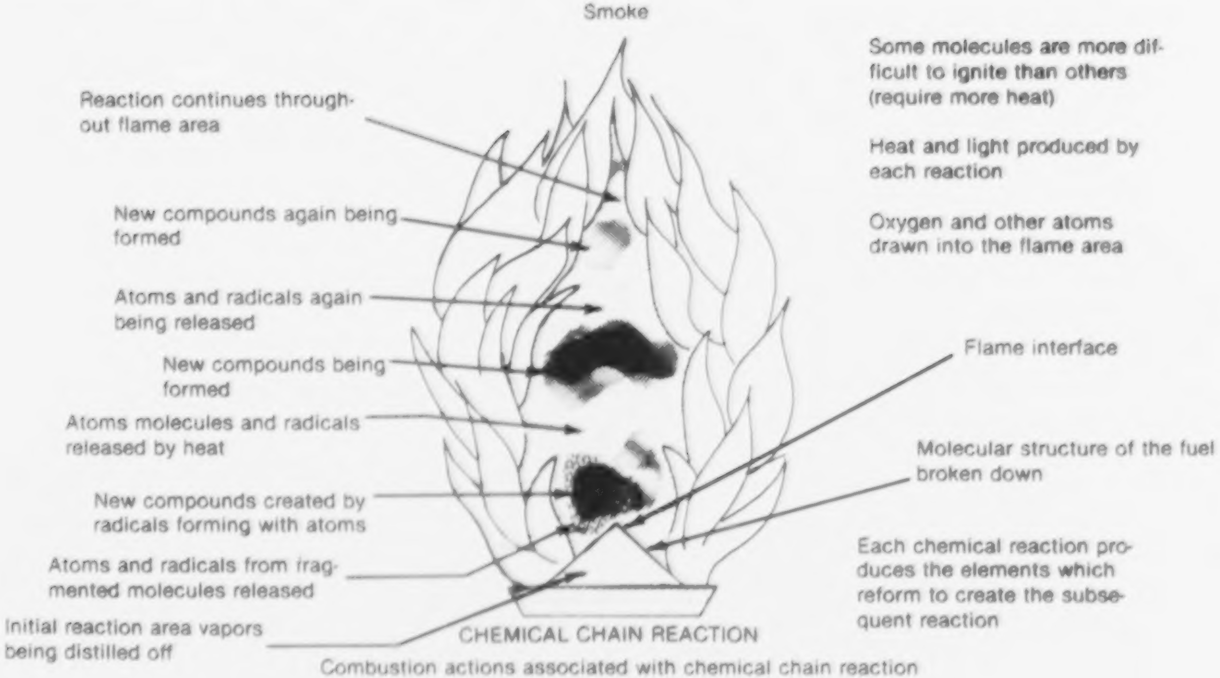
CHEMICAL CHAIN REACTION


Smoke
Reaction continues throughout flame area
New compounds again being formed
Atoms and radicals again being released
New compounds being formed
Atoms molecules and radicals released by heat
New compounds created by radicals forming with atoms
Atoms and radicals from fragmented molecules released
Initial reaction area vapors being distilled off
Some molecules are more difficult to ignite than others (require more heat)
Heat and light produced by each reaction
Oxygen and other atoms drawn into the flame area
Flame interface
Molecular structure of the fuel broken down
Each chemical reaction produces the elements which reform to create the subsequent reaction

CHEMICAL CHAIN REACTION

Combustion actions associated with chemical chain reaction

Used with permission of Fire Protection Publications from *Essentials of Fire Fighting*.
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FIRE EXTINGUISHMENT THEORY

The extinguishment of a fire is based on the interruption of one or more of the essential elements in the combustion process. Generally, four methods may be used to extinguish fire.

- **Reduction of temperature**—Fuel is cooled to the point where it does not produce sufficient vapor to burn; the most common cooling agent is water, which also converts to steam and smothers the fire.

- **Removal of fuel**—Flow of liquid or gaseous fuel is stopped, or solid fuel is removed from the path of the fire; fire may also be allowed to burn until all fuel is consumed.

- **Exclusion of oxygen**—Oxygen concentration in the fire areas is reduced, an inert gas is introduced, or oxygen is separated from the fuel.

  NOTE: This method of extinguishment does not work on self-oxidizing material or on certain metals as they are oxidized by carbon dioxide or nitrogen—the two most common extinguishing agents.

- **Inhibition of chain reaction**—Flame-producing chemical reaction is interrupted with the use of such extinguishing agents as dry chemicals or halons.

  NOTE: Chemical flame inhibition is effective only on gas or liquid fuels because they cannot burn in the smoldering chemical reaction; it extinguishes by removing oxygen.

INFORMATION SHEET | DEMONSTRATE GENERAL SAFETY PRACTICES | II

OBJECTIVE 1

Match terms associated with general safety practices to their correct definitions.

- **Accident**—Any suddenly occurring, unintentional event that causes injury or property damage
- **Carelessness**—Failure to think before one acts; failure to pay attention
- **Combustible**—Capable of bursting into flames
- **Corrosive**—Tending to weaken or destroy, especially through chemical action
- **Extinguish**—To put out a fire; to cause to cease burning
- **First aid**—Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained
- **Flammable**—Capable of being easily ignited and burning quickly

  NOTE: *Inflammable* means "flammable."
- **Hazard**—Source of danger
- **Safety**—Freedom from danger, risk, or injury

OBJECTIVE 2

State the major causes of accidents.

NOTE: Most accidents are caused by carelessness and negligence—not paying attention to possible hazards, becoming distracted by inner thoughts instead of keeping your mind on the job. Inappropriate behavior such as horseplay or rowdiness puts others in danger.

The best accident prevention is having a "Safety Attitude"—looking for and avoiding possible injuries to yourself and your coworkers.

- Carelessness
- Forgetting or disregarding safety practices
- Not knowing how to operate equipment properly

- Improper use of equipment

OBJECTIVE 3

State jobsite safety practices.

Safety is everybody's job. You are responsible for your safety and for that of the people around you.

- Stay alert

  NOTE: Do not operate power tools or work with moving equipment if you are very tired. Practice the A's of safety: Attitude and Awareness.

- Conduct yourself in a safe manner
- Actively look for potential hazards

  EXAMPLES: Tools left where they can be stepped on, wet floors, someone smoking around gasoline or fuels, broken tools, oily rags left in the open instead of in metal cans, chemicals left out, inadequate lighting, etc.

- Be aware of the people working around you

  NOTE: Know what they are doing, where they are working and the possible accidents that might occur. Be ready to help.

- Follow standard company procedures at all times—Safety is organization
- Know the location of first-aid equipment and fire extinguishers
- Use the proper tools for the job
- Know the safety regulations for all equipment or tools you use
- Stay clear of operating equipment unless you have a specific job
- Never use alcohol or drugs around equipment

  NOTE: "Drugs" include hay fever, headache, or other medications that can make you drowsy.

- Report all defects in tools, supplies, and equipment to your immediate supervisor

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- Report all accidents to your supervisor, regardless of the nature or severity
- Wear proper protective clothing for the situation

  NOTE: See Objective 11.

OBJECTIVE 4 **List types of common job-related injuries.**

- Fractures
- Burns
- Sprains
- Back injuries

  NOTE: Improper lifting is a major cause of back injuries.
- Cuts
- Eye injuries
- Bruises
- Scrapes
- Dislocations
- Crushed bones and organs

OBJECTIVE 5 **Complete statements about first-aid kits.**

NOTE: First-aid training and a short course in CPR (cardiopulmonary resuscitation - what to do in case someone has a heart attack) are wise investments for everyone.

- First-aid can prevent infection, give comfort and assurance to a victim, and in extreme cases can save an arm or a leg—or a life. Training is available through your local Red Cross office.

- Industrial kits are usually painted Federal Safety Green with a cross.

  NOTE: Federal safety green is used to identify safety equipment other than fire extinguishers.

- First-aid kits come in two basic types:

  Unit-type—Has a complete assortment of materials in single units or in multiples. Each unit contains one or more individual dressings with liquids packaged in unbreakable, nonleak ampules.

  Cabinet-type—Made for a wide variety of uses and ranges from pocket-size to large, industrial sizes. They usually contain a large supply of materials which are replaced as needed.

- Kits should contain sterile dressings, prepared splints, and other emergency equipment ready for use before an accident occurs.

  EXAMPLES: Antiseptic to kill germs and bacteria
  Adhesive bandages for various sized wounds
  Gauze pads, various sizes
  Gauze roller bandages
  Triangular bandages for large wounds and slings
  Tourniquet to control massive bleeding
  Scissors
  Tweezers
  Elastic bandages for sprains
  Pain relievers

OBJECTIVE 6

Match the basic classes of fires with examples of each class. (Transparency Masters 1 through 6)

- **Class A**—Ordinary combustibles such as wood, paper, cloth
- **Class B**—Flammable liquids such as grease, gasoline, oils, paints
- **Class C**—Electrical equipment such as motors, switches, computers
- **Class D**—Combustible metals such as zinc, magnesium, potassium

OBJECTIVE 7

Match types of fire extinguishers to the classes(es) of fires on which each is used. (Transparency Masters 7 and 8, Job Sheet 1)

- **Carbon dioxide (Carbon dioxide gas under pressure)**—Used to extinguish Class B and C fires
- **Pump tank (plain water)**—Used to extinguish Class A fires
- **Multi-purpose dry chemical**—Used to extinguish Class A, B, and C fires
- **Ordinary dry chemical**—Used to extinguish Class B and C fires
- **Halon**—Used to extinguish Class B and C fires

  NOTE: Halon does not harm computer equipment.
- **Dry powder**—Used only on Class D fires

OBJECTIVE 8

State the information to be given when reporting a fire.

There are two common methods of reporting a fire: by telephone and with a pullbox alarm switch. Some pullbox alarm switches automatically signal the fire department or police and provide the location; some only sound an alarm in the building. It is recommended that even when the pullbox is used, the fire should also be reported by phone to provide more specific information.

WARNING: It is *against the law* to make a false fire report!

When reporting a fire by telephone, *stay calm* and give the following information:

- Your name
- Exact address and fire location—"1919 South Ash Street, in the storeroom."
- The type of fire—Wood, electric, liquid, metal, etc.
- Any other helpful information—"Paint, chemicals, and other flammable materials are in the storeroom."

OBJECTIVE 9

State electrical safety measures.

- Make sure equipment is in good condition and properly grounded, if required.

  NOTE: Frayed or nicked cords can cause overheating or fires.

- Use special equipment that will not arc or spark when working in flammable or explosive surroundings.
- Never throw water on an electrical fire.
- Avoid using extension cords that may overheat and cause a fire.

  NOTE: Never use extension cords smaller than the tool cord. Do not cut off grounding wire.

- Never use electrical equipment while your skin is wet.
- Never use electrical equipment while standing on or touching wet areas.

OBJECTIVE 10

State chemical safety precautions.

Chemicals can include cleaning products, solvents, disinfectants, pesticides, preservatives, or other substances that can cause injury or illness when inhaled, swallowed, or allowed to come in contact with the skin.

- Wear protective clothing.

  NOTE: Safety glasses, waterproof gloves and boots must always be worn when working with chemicals; breathing apparatus should be used when chemicals are sprayed.

- Store chemicals properly.

  NOTE: Chemicals should be kept separate from other substances, in a dry area, according to directions on the label.

- Never smoke, eat, or drink while handling chemicals.

  NOTE: Toxic chemicals can be easily transferred from hand to mouth.

- Wash all exposed body surfaces with soap and water immediately after handling or contact with chemicals.

NOTE: Wash after touching surfaces sprayed with chemicals.

- If chemicals are spilled onto clothing, remove clothing immediately and wash exposed skin with soap and water.

CAUTION: **Do not wash contaminated clothing with other laundry.**

- Avoid inhaling sprays, dusts, or vapors.

NOTE: If toxin is inhaled, get to fresh air immediately.

- If chemical gets into eyes, flush eyes with water for 10-15 minutes and get medical attention.

- If medical treatment is required, take the chemical label to the doctor or hospital.

NOTE: If chemicals are accidently swallowed, or if illness or other reaction occurs shortly after chemical exposure, get immediate medical attention or call a poison control center.

- Dispose of chemicals and containers according to the label.

NOTE: Chemicals and their containers can cause serious pollution and some can cause toxic fires. They should *never* be poured down a drain or placed with ordinary waste, unless specified on the label.

OBJECTIVE 11

List common protective equipment used in processing agricultural products. (Supplement 1)

- Ear plugs

- Aprons

- Gloves

WARNING: Never wear gloves when using equipment that can catch the glove and pull your hand into the equipment.

- Hair nets

- Protective eyewear

EXAMPLES: Safety glasses, goggles, face shields, depending on the task

- Protective footwear

- Hard hats
- Belly guards
- Waterproof clothing

SAFETY EQUIPMENT AND SAFETY DESIGN FACTORS FOUND IN AGRICULTURAL PRODUCTS PROCESSING PLANTS

Many of the factors for safety are also included in the sanitation factors required by law.

- Protective clothing
- Nonslip flooring
- Sizes, types, and number of doors
- Floor drains
- Sinks
- Lifting equipment
- Types of tools and equipment used for processing
- Exhaust fans
- Controlled climate
- First-aid equipment
- Fire-fighting equipment
- Number of exits
- Types of knives/tools used
- Table heights

Ergonomics (ur-go-NOM-iks) is the science of designing and engineering furniture, tools, equipment and other objects used and operated by the human body in such a way as to support the body and prevent physical strain.

Cars, office furniture, hand tools, assembly-line equipment, computers and other items are often ergonomically designed. In the agricultural processing business, new types of knives, tools, adjustable tables and work stations are being developed to alleviate joint and back injuries.

OXYGEN SOURCE

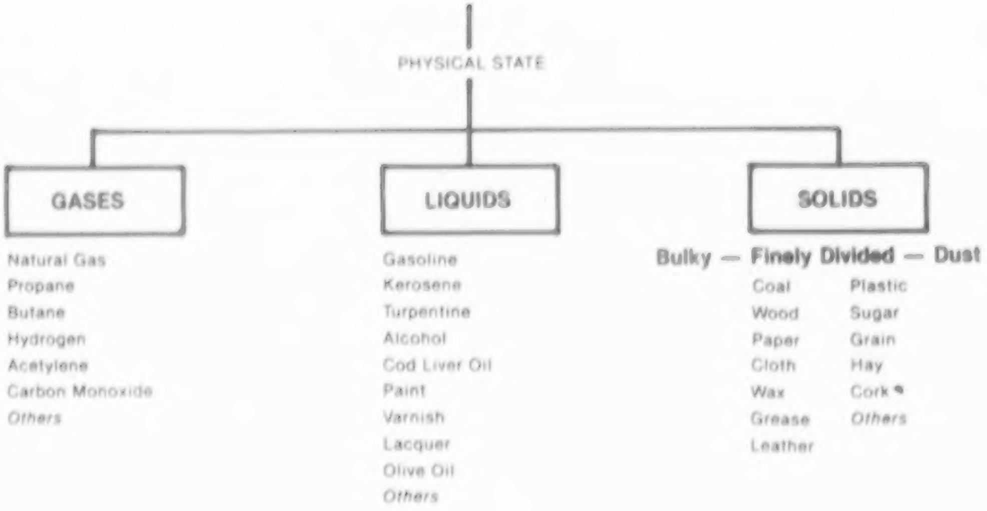
Approximately 16% Required

Normal air contains 21% O_2.
Some fuel materials contain
sufficient oxygen within
their make-up to support
burning.

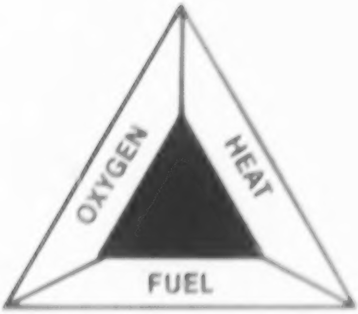
HEAT SOURCES

To Reach Ignition Temperature

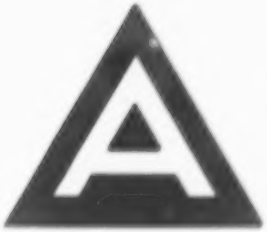
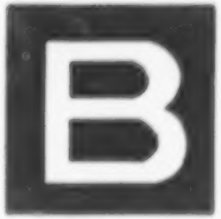
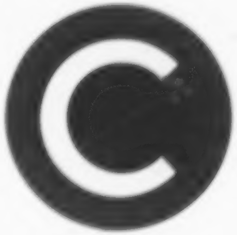
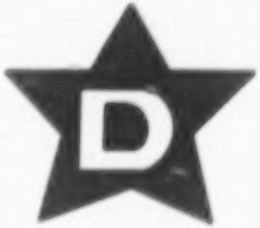
Open Flame — The Sun
Hot Surfaces
Sparks and Arcs
Friction — Chemical Action
Electrical Energy
Compression of Gases


PHYSICAL STATE
GASES
LIQUIDS
SOLIDS
Natural Gas
Propane
Butane
Hydrogen
Acetylene
Carbon Monoxide
Others
Gasoline
Kerosene
Turpentine
Alcohol
Cod Liver Oil
Paint
Varnish
Lacquer
Olive Oil
Others
Bulky — Finely Divided — Dust
Coal
Wood
Paper
Cloth
Wax
Grease
Leather
Plastic
Sugar
Grain
Hay
Cork
Others

Used with permission of the Board of Regents, Oklahoma State University, Stillwater, Oklahoma, from *Essentials of Fire Fighting*, 2nd edition, Gene P. Carlson and William Vandevort, eds., 1983.


OXYGEN
HEAT
FUEL

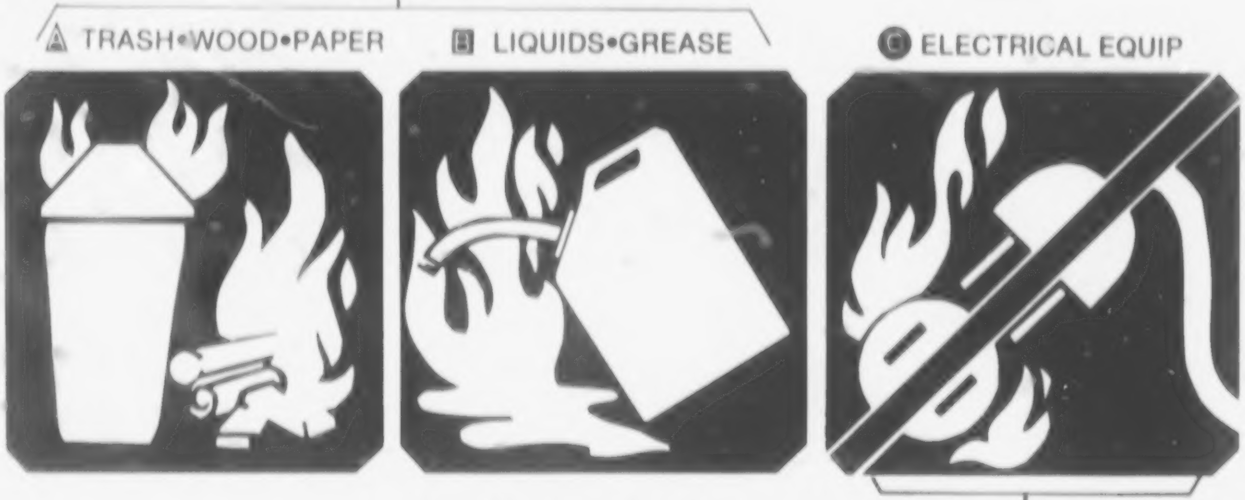
Standard Letter Symbols for Fire Extinguishers

GREEN	RED	BLUE	YELLOW
			
ORDINARY COMBUSTIBLES	FLAMMABLE LIQUIDS	ELECTRICAL EQUIPMENT	COMBUSTIBLE METALS

Distinctive letters, shapes, and colors mark extinguishers according to the classes of fires on which they should be used.

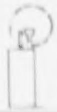
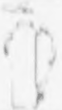
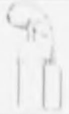
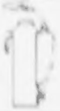
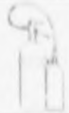
New Pictorial Symbols Used to Label Fire Extinguishers

Symbols with blue backgrounds indicate fire extinguisher can be used for class of fire portrayed.


A TRASH•WOOD•PAPER
B LIQUIDS•GREASE
C ELECTRICAL EQUIP

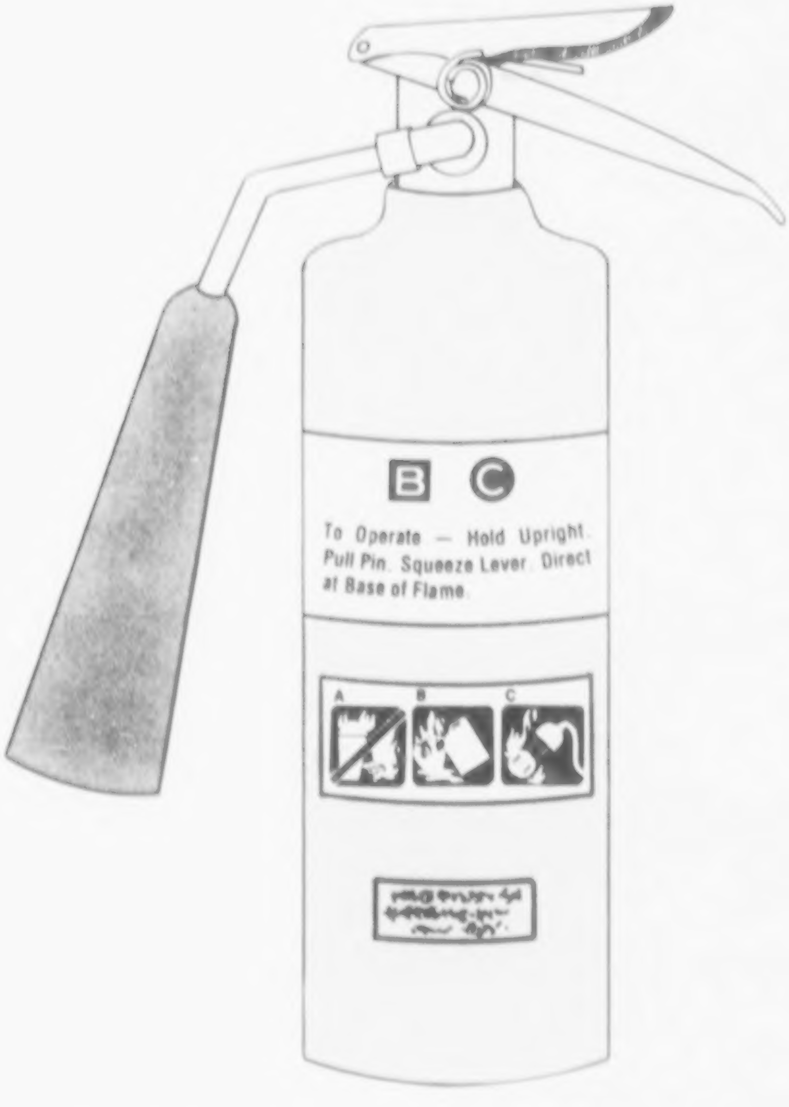
Symbols with red line across a black background indicate fire extinguisher *cannot* be used for class of fire portrayed.

TYPES OF FIRE EXTINGUISHERS

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER					
		MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important: Using the wrong type extinguisher for the fire may be dangerous					
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING . . .	THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	PUMP TANK Plain Water	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL	HALON	DRY POWDER
A **CLASS A FIRES** Use These Extinguishers ORDINARY COMBUSTIBLES • Wood • Paper • Cloth, etc.							
B **CLASS B FIRES** Use These Extinguishers FLAMMABLE LIQUIDS, GREASE • Gasoline • Paints • Oils, etc.							
C **CLASS C FIRES** Use These Extinguishers ELECTRICAL EQUIPMENT • Motors • Switches, etc.							
D **CLASS D FIRES** Use This Extinguisher COMBUSTIBLE METALS • Iron • Magnesium							

Adapted with permission of American Association for Vocational Instructional Materials, Athens, Georgia, from *Developing Shop Safety Skills* by Clinton O. Jacobs and J. Howard Turner, 1981

Fire Extinguisher Suitable for Class B and Class C Fires


B
C
To Operate — Hold Upright. Pull Pin. Squeeze Lever. Direct at Base of Flame.
A
B
C

ASSIGNMENT SHEET 1

DEMONSTRATE GENERAL SAFETY PRACTICES

II

OBJECTIVE 12

Complete an accident report.

NAME ______________________________ SCORE ________

INTRODUCTION

Accident reports are very important for the individuals involved both directly and indirectly. Therefore, it is imperative that a report be completed with each accident regardless of its degree of seriousness.

DIRECTIONS

Complete an accident report for each of the following scenarios. Use the forms on the following pages to complete your reports. Use your imagination to fill in any information that is not provided in the scenario. Pay special attention to the question involving what you would suggest to prevent similar accidents.

1. You are the supervisor of the day shift at a canning factory. The line chief reports to you that an employee has severely injured his hand when it was pulled into a can sealer. The chief also states that a hand shield was removed when the equipment was overhauled and it was not replaced. The employee was wearing gloves at the time of the accident.

2. Your plant has to fill a large rush order and an additional work station has been installed in your department. You have had to use two extension cords to reach an outlet for your equipment. The cords are not the proper rating. They overheat, igniting a pile of oily rags. The fire is extinguished only after a fully charged extinguisher is found. Several pieces of equipment are destroyed and two workers are slightly burned.

ACCIDENT REPORT

This report is to be filed with the Manager's Office within 24 hours of the accident. The filing time may be adjusted for weekend or holiday accidents. Supervisors are to use this form for all injury and non-injury accidents including those involving employees and private property. Feel free to use additional accident forms or add additional information on a separate sheet of paper. Place N/A in sections of this report not applicable to the accident.

Report Prepared by________________ Title ____________________

Time of Accident ________________ AM/PM Date _____________ Year _____________

Location of Accident ____

Time of Filing With Manager's Office___________________________

Briefly describe the accident including causes and reasons. Attach any diagrams or photographs that will assist in understanding the accident.

____

____

____

Injured Employee #1 _____________ Age__________________ Job Tenure__________
Classification__________________ Department/Division ________

Injured Employee #2 _____________ Age__________________ Job Tenure__________
Classification__________________ Department/Division ________

Injured Citizen #1_______________ Age__________________ Home Phone# _______
Address_______________________ Employer___________________________________
Business Phone#________________ Social Security # __________
Classification__________________ Department/Division ________

Injured Citizen #2_______________ Age__________________ Home Phone# _______
Address_______________________ Employer___________________________________
Business Phone#________________ Social Security # __________
Classification__________________ Department/Division ________

Describe exactly which part of the body was injured. Use the diagrams attached to mark where the injury or injuries were located.

____

____

Specify any first-aid treatment and whom it was given by.

____

____

Where were the injured parties taken for treatment and by whom? Who authorized treatment?

____

Treatment refused by:__________________________ (Signature of injured person and date.)

(OVER)

Who administered any medical treatment? ______________________________

____

Time lost from job by injured employee and other employees assisting with the response to the accident. ______________

Describe any tools, machinery, equipment, or materials associated with the accident. ______________

____

____

Briefly describe or list damage to company property. Attach photographs. ______________

____

____

Briefly describe or list damage to private property. Attach photographs. ______________

____

____

List the name, address, and telephone number (both work and home) of persons who witnessed or have knowledge of the circumstances surrounding the accident.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

List the reports, statements, or other documentation which are attached to support or clarify the facts relating to this accident. This should include all relevant police reports and reports which expand on the information provided in this report.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

What do you propose to prevent similar accidents? ______________

____

____

____

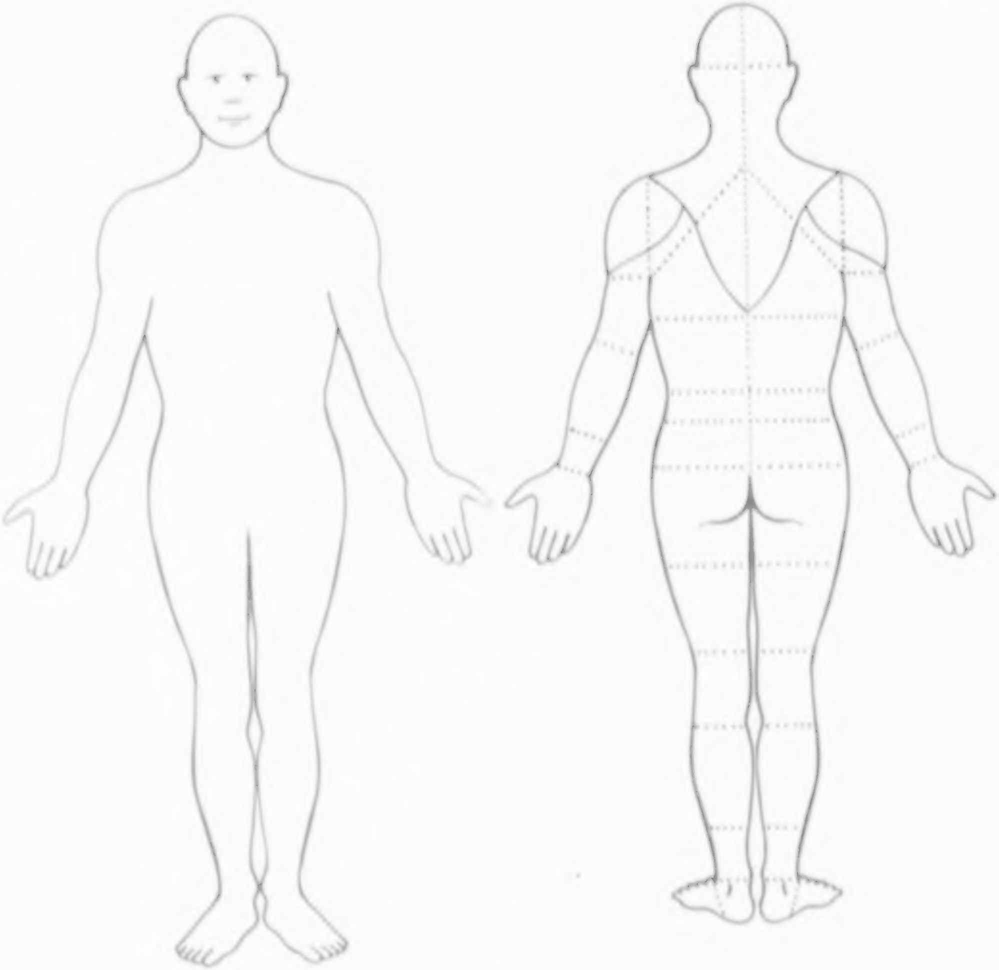
What actions have been taken to date? What actions are planned and when will they be taken?

____

____

____

Reviewed by: ______________ Involved Employee ______________ Supervisor ______________ Department Head



ACCIDENT REPORT

This report is to be filed with the Manager's Office within 24 hours of the accident. The filing time may be adjusted for weekend or holiday accidents. Supervisors are to use this form for all injury and non-injury accidents including those involving employees and private property. Feel free to use additional accident forms or add additional information on a separate sheet of paper. Place N/A in sections of this report not applicable to the accident.

Report Prepared by ______________ Title ________________

Time of Accident ______________ AM/PM Date ____________ Year ____________

Location of Accident ____

Time of Filing With Manager's Office ____________________

Briefly describe the accident including causes and reasons. Attach any diagrams or photographs that will assist in understanding the accident.

____

____

____

Injured Employee #1 ______________ Age ________________ Job Tenure ________
Classification ______________ Department/Division ________

Injured Employee #2 ______________ Age ________________ Job Tenure ________
Classification ______________ Department/Division ________

Injured Citizen #1 ______________ Age ________________ Home Phone# ________
Address ______________ Employer ____________________________
Business Phone# ______________ Social Security # ________
Classification ______________ Department/Division ________

Injured Citizen #2 ______________ Age ________________ Home Phone# ________
Address ______________ Employer ____________________________
Business Phone# ______________ Social Security # ________
Classification ______________ Department/Division ________

Describe exactly which part of the body was injured, use the diagrams attached to mark where the injury or injuries were located.

____

____

Specify any first-aid treatment and whom it was given by.

____

____

Where were the injured parties taken for treatment and by whom? Who authorized treatment?

____

Treatment refused by: ______________________ (Signature of injured person and date.)

(OVER)

Who administered any medical treatment? ______________________________

____

Time lost from job by injured employee and other employees assisting with the response to the accident. ____________________

Describe any tools, machinery, equipment, or materials associated with the accident. __________

____

____

Briefly describe or list damage to company property. Attach photographs. __________

____

____

Briefly describe or list damage to private property. Attach photographs. __________

____

____

List the name, address, and telephone number (both work and home) of persons who witnessed or have knowledge of the circumstances surrounding the accident.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

List the reports, statements, or other documentation which are attached to support or clarify the facts relating to this accident. This should include all relevant police reports and reports which expand on the information provided in this report.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

What do you propose to prevent similar accidents? ____________________

____

____

____

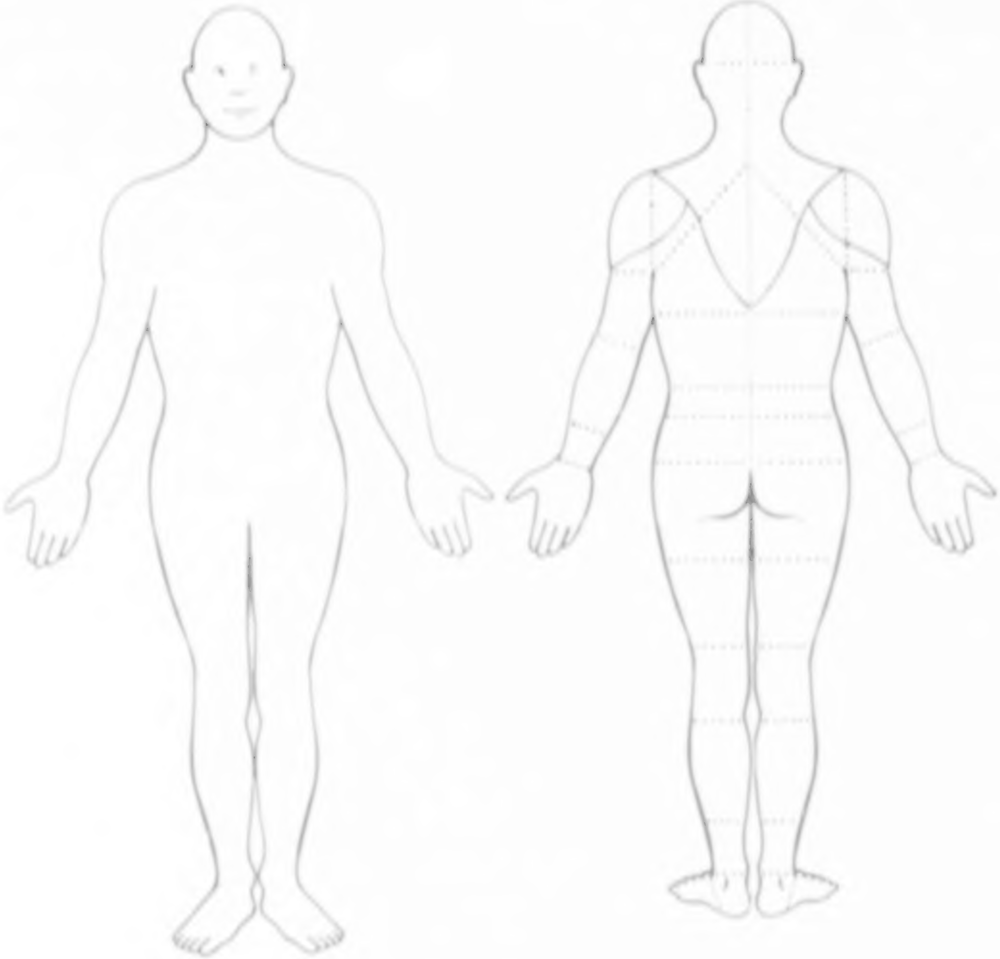
What actions have been taken to date? What actions are planned and when will they be taken?

____

____

____

Reviewed by:	____________	____________	____________
	Involved Employee	Supervisor	Department Head



ASSIGNMENT SHEET 2

DEMONSTRATE GENERAL SAFETY PRACTICES

OBJECTIVE 13 **Correct safety hazards.**

NAME ______________________________ SCORE ________

INTRODUCTION Safety hazards are generally easy to correct in most up-to-date facilities. This assignment will help you recognize the ways that you as an employee can make your work environment safe.

DIRECTIONS List all of the hazards in an area designated by your instructor and list methods of correcting those hazards.

NOTE: Your instructor may have you correct those hazards.

Hazard	Correction

ASSIGNMENT SHEET 1

Check that

- Forms are properly filled out
- Suggested prevention for item 1 should include inspection of equipment; employee should not have been wearing gloves around moving parts
- Suggested prevention for item 2 should include using correctly-rated extension cords; frequent inspection of fire extinguishers; keep oily rags in metal containers

ASSIGNMENT SHEET 2

- Make sure that student has correctly identified all of the hazards in the designated area and listed a method for correcting the hazard.

OBJECTIVE 14 **Operate a fire extinguisher.**

INTRODUCTION

Fires can start without warning. It is extremely important that every person be trained on the very simple steps of operating a fire extinguisher. If a fire can be extinguished within two minutes, thousands of dollars and even lives can be saved. Quick response and a calm, cool mind are all that are required in using a fire extinguisher properly.

TOOLS AND EQUIPMENT

- 1 ABC class fire extinguisher

PROCEDURE

1. Identify the type of fire (the fuel).
2. Select the correct type of fire extinguisher.
3. Remove extinguisher from wall bracket.
4. PULL the pin at the top of the extinguisher that keeps the handle from being pressed. Break the plastic or thin wire inspection band.

   NOTE: Carry and operate the extinguisher in its upright position. Only obsolete soda-acid, foam, and cartridge-operated water extinguishers are designed to be turned upside down.

5. POINT the nozzle or outlet toward the fire.

   NOTE: Some hose assemblies are clipped to the body of the extinguisher. Release the hose assembly, then point.

6. PRESS the handle above the carrying handle to discharge the contents.

   NOTE: You can release the handle to stop the discharge at any time.

7. SWEEP the nozzle back and forth at the base of the flames to spread the extinguishing agent.

   NOTE: After the fire is out, look for smoldering hot spots or reflash of flammable liquids. Be sure the fire is out!

8. Have your instructor check your work.

9. Clean the area and put away tools.

PRACTICAL TEST 1

DEMONSTRATE GENERAL SAFETY PRACTICES

II

JOB SHEET 1

Operate a fire extinguisher.

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the material and try again.

The student:	YES	NO
1. Identified the type of fire (the fuel)	_____	_____
2. Selected the correct type of fire extinguisher.	_____	_____
3. Removed extinguisher from wall bracket.	_____	_____
4. Pulled the pin at the top of the extinguisher that keeps the handle from being pressed.	_____	_____
5. Broke the plastic or thin wire inspection band.	_____	_____
6. Pointed the nozzle or outlet toward the fire.	_____	_____
7. Pressed the handle above the carrying handle to discharge the contents.	_____	_____
8. Swept the nozzle back and forth at the base of the flames to spread the extinguishing agent.	_____	_____
9. Used proper tools correctly.	_____	_____
10. Performed steps in a timely manner.	_____	_____
11. Practiced safety rules through procedure.	_____	_____
12. Provided satisfactory responses to questions asked.	_____	_____
13. Put away tools and cleaned work area.	_____	_____

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "4" to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:	4	3	2	1
Properly operated fire extinguisher				

EVALUATOR'S COMMENTS

____

____

____

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

WRITTEN TEST

DEMONSTRATE GENERAL SAFETY PRACTICES

II

NAME ______________________________ SCORE ________

OBJECTIVE 1

Match terms associated with general safety practices to their correct definitions. Write the correct letters in the blanks.

____ 1. Source of danger

____ 2. Capable of bursting into flames

____ 3. Any suddenly occurring, unintentional event that causes injury or property damage

____ 4. Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained

____ 5. Failure to think before one acts; failure to pay attention

____ 6. To put out a fire; to cause to cease burning

____ 7. Freedom from danger, risk, or injury

____ 8. Capable of being easily ignited and burning quickly

____ 9. Tending to weaken or destroy, especially through chemical action

a. Burnable

b. Hazard

c. Health hazard

d. First aid

e. Rust

f. Corrosive

g. Sprinkler system

h. Rupture

i. Accident

j. On-site care

k. Stretcher

l. Flammable

m. Safety

n. Extinguish

o. Flame out

p. Carelessness

q. Combustible

OBJECTIVE 2 State the major causes of accidents.

OBJECTIVE 3 State jobsite safety practices. State six practices.

OBJECTIVE 4

List types of common job-related injuries. List eight types.

____

____

____

____

____

____

____

____

OBJECTIVE 5

Complete statements about first-aid kits. Write the correct words or phrases in the blanks.

1. A ____________ first-aid kit usually contains a large supply of materials which are replaced as needed.
2. First-aid training is available from your local ____________ office.
3. Industrial kits are usually painted ____________ with a cross.
4. Kits should contain sterile dressings, prepared splints, and other emergency equipment ready for use ____________ .

OBJECTIVE 6

Match the basic classes of fires with examples of each class. Write the correct letters in the blanks.

____ 1. Ordinary combustibles such as wood, paper, cloth

____ 2. Flammable liquids such as grease, gasoline, oils, paints

____ 3. Electrical equipment such as motors, switches, computers

____ 4. Combustible metals such as zinc, magnesium, potassium

a. Class A, B, C

b. Class D

c. Class B

d. Class C

e. Class A

OBJECTIVE 7

Match types of fire extinguishers to the class(es) of fires on which each is used. Questions may have more than one correct answer.

____1. Used to extinguish Classes B and C fires

____2. Used to extinguish Class A fires

____3. Used to extinguish Classes A, B, and C fires

____4. Used to extinguish Class D fires

a. Pump tank (plain water)

b. Multi-purpose dry chemical

c. Ordinary dry chemical

d. Carbon dioxide (Carbon dioxide gas under pressure)

e. Halon

f. Dry powder

OBJECTIVE 8

State the information to be given when reporting a fire.

OBJECTIVE 9

State electrical safety measures. Write six safety measures in the space below.

OBJECTIVE 10 **State chemical safety precautions.** Write eight precautions in the space below.

OBJECTIVE 11 **List common protective equipment used in processing agricultural products.** Write five kinds of protective equipment in the space below.

NOTICE The following assignment sheets and job sheet are not a part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 12 **Complete an accident report.** SCORE ________

OBJECTIVE 13 **Correct safety hazards.** SCORE ________

OBJECTIVE 14 **Demonstrate the ability to operate a fire extinguisher.** RATING _______

WRITTEN TEST ANSWERS

DEMONSTRATE GENERAL SAFETY PRACTICES

II

OBJECTIVE 1

1. b
2. q
3. i
4. d
5. p
6. n
7. m
8. l
9. f

OBJECTIVE 2

- Carelessness
- Forgetting or disregarding safety practices
- Not knowing how to operate equipment properly
- Improper use of equipment

OBJECTIVE 3

Answer may include any six of the following:

- Stay alert
- Conduct yourself in a safe manner
- Actively look for potential hazards
- Be aware of the people working around you
- Follow standard company procedures at all times
- Know the location of first-aid equipment and fire extinguishers
- Use the proper tools for the job
- Know the safety regulations for all equipment or tools you use
- Stay clear of operating equipment unless you have a specific job
- Never use alcohol or drugs around equipment

- Report all defects in tools, supplies, and equipment to your immediate supervisor
- Report all accidents to your supervisor, regardless of the nature or severity
- Wear proper protective clothing for the situation

OBJECTIVE 4

Answer may include any eight of the following:

- Fractures
- Burns
- Sprains
- Back injuries
- Cuts
- Eye injuries
- Bruises
- Scrapes
- Dislocations
- Crushed bones and organs

OBJECTIVE 5

1. cabinet-type
2. Red Cross
3. Federal Safety Green
4. before an accident occurs

OBJECTIVE 6

1. e
2. c
3. d
4. b

OBJECTIVE 7

1. b, c, d, e
2. a, b
3. b
4. f

OBJECTIVE 8

Answer should include:

- Your name
- Exact address and fire location
- The type of fire
- Any other helpful information

OBJECTIVE 9

Answer should include:

- Make sure equipment is in good condition and properly grounded if required.
- Special equipment that will not arc or spark is required for work in flammable or explosive surroundings.
- Never throw water on an electrical fire.
- Avoid using extension cords that may overheat and cause a fire.
- Never use electrical equipment while your skin is wet.
- Never use electrical equipment while standing on or touching a wet area.

OBJECTIVE 10

Answer may include any eight of the following:

- Wear protective clothing as needed
- Store chemicals properly
- Never smoke, eat or drink while handling chemicals
- Wash all exposed body surfaces with soap and water immediately after handling or contact with chemicals

- If chemicals are spilled onto clothing, remove clothing immediately and wash exposed skin with soap and water
- Avoid inhaling sprays, dusts, or vapors
- If chemical gets into eyes, flush eyes with water for 10-15 minutes and get medical attention
- If medical treatment is required, take the chemical label to the doctor or hospital
- Dispose of chemicals or containers according to the label

OBJECTIVE 11 Answer may include any five of the following:

- Ear plugs
- Aprons
- Gloves
- Hair nets
- Protective eyewear
- Protective footwear
- Hard hats
- Belly guards
- Waterproof clothing

OBJECTIVE 12 Refer to answers to Assignment Sheet 1.

OBJECTIVE 13 Refer to answers to Assignment Sheet 2.

OBJECTIVE 14 Refer to Practical Test for Job Sheet 1.

OBJECTIVE SHEET

MEAT PRODUCTS

III

INTRODUCTION

Meat has always been one of man's favorite and most nutritious foods. Beef, lamb, and pork are three of today's most common meats. Scientific research and selective breeding have improved the quantity and quality of today's meats. Regulation and standardization of the industry have also contributed to the safe and succulent meat supply available to today's consumers.

UNIT OBJECTIVE

After completing this unit the student should know basic primal and retail cuts of beef, lamb, and pork; understand basic grades and grading procedures; be able to identify meat by-products, fresh, cooked, and smoked/cured meat products; be able to calculate costs and assess other aspects of slaughter dressing and processing of beef, lamb, and pork and judge meat classes. The student will demonstrate these competencies by completing assignments sheets and the written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with meat products to their correct definitions.
2. Select from a list true statements about the eating quality of meat.
3. List types of meat by-products and common products derived from each one.
4. List forms of meat available to consumers.
5. Label the basic wholesale (primal) cuts of beef, pork, and lamb.
6. Name the primal cut from which retail cuts are taken.
7. Arrange in order beef and lamb quality grades.
8. Discuss beef and lamb yield grades.
9. List pork grades.
10. List average and normal slaughter weights for beef, pork, and lamb.

11. Select from a list information found on meat labels.

12. Calculate cost of processing at a locker plant. (Assignment Sheet 1)

13. Survey types of meat products found locally. (Assignment Sheet 2)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

- Make arrangements with local meat locker or butcher for samples of meat grades and cuts to be presented to students.

- Invite a rancher, county extension agent, meat inspector or veterinarian to speak to the class about live animal evaluation and selection.

- Invite a butcher or home economist to speak to the class about meat cuts, grading, taste, and other related topics.

- Have a variety of charts available illustrating various cuts, grades, and skeletal systems of beef, lamb, and pork.

- Arrange for the students to see and handle meat and livestock whenever possible during the unit.

- Students will be more familiar with some cuts or types of meat than with others. Throughout the unit, compare the three animals and stress common elements.

DELIVERY

Objectives 1

- Many of these terms will be familiar to students. Use the familiar terms to give the students a sense of what the unit is about.

- Have students collect articles from newspapers and other periodicals dealing with the subjects covered.

- Have a county extension agent discuss the meats commonly raised in your area and the effect of this industry on the local community.

Objective 2

- Have students list words used to describe meat i.e., delicious, moist.

- Discuss meat smells (bacon frying, BBQ, turkey baking, etc.).

Objective 3

- Before the information is presented, ask students to estimate what percentage of a carcass is actually meat and to list as many by-products and uses they can think of.

- Count the number of items visible in the classroom which use some meat by-product. Don't forget lubricants or plastics.

- Invite a chemist or medical researcher to discuss the use of by-products.

- Show the students examples of bone, meat, and blood meal.

Objective 4

- Tell students that before modern preservation methods were available smoking and curing were among the few ways meat could be preserved.

Objectives 5 and 6

- Arrange for students to see primal cuts of all three animals. Note the amount of fat left on the meat at this point. Decide what retail cuts could be taken from the primal cuts presented.

- Present retail cuts and ask from what primal cut it originated.
- Explain to students that the less a muscle is used, the more tender it is. Locate the areas of a carcass which were least and most used. Locate most and least tender cuts. Note the correlation.
- To help students remember skeletal landmarks, have them locate the corresponding bone or joint on their own skeleton. Continue the exercise by having them name the primal or retail cut their rib, leg, etc. would be if they were a cow, a lamb, or a hog.
- Compare the cuts to one another in relation to skeletal landmarks. (See Supplement 1 for bones common to similar cuts)

Objectives 7 through 9

- Expose the students to samples of various grades, using both photos and actual cuts of meats.
- Invite a butcher, home economist, meat processor, or cook to discuss the difference in grades.
- Have students study photos or samples of meat grades and list differences.
- Have students prepare and taste meats from different grades and compare them for appearance and taste.
- Use any student experiences in grading, such as in competition, as a comparison.
- Photographs or live examples should be used as much as possible.
- Have students compile and use similar quality and quantity grades on other items: quantity vs. quality of homework, television, etc.

Objective 10

- Invite a rancher or economist to discuss the market and its effect on optimum slaughter weight.

- Note that these weights are averages. Discuss factors such as feed costs, market price, etc. which may lead a rancher to slaughter at different weights.

Objective 11

- Bring several labels from packaged meat products and have students note the various components.

APPLICATION

Objective 12

- Use Assignment Sheet 1 to give students practice calculating processing costs.
- Compare the cost the students arrive at to the cost of meat advertised in that week's newspapers.
- Invite a home economist to discuss the cost of meat to the average family.

Objective 13

- Use Assignment Sheet 2 to introduce students to unfamiliar meat products and by-products.
- Have students survey the meat products they find at home.
- Invite a Native American, or foreign visitor to describe uses of meat products students may be unfamiliar with.

SUGGESTED RESOURCES

Publications

- Romans, John R., *et al, The Meat We Eat.* A textbook on the conversion of animals into human food, it presents a clear-cut, step-wise progression that leads through the process logically from whole live animals to the many forms of nutritious, appetizing food products. Available from Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61834-0050, phone 1-800-843-4774.
- Meat Identification charts, available for beef, pork, and veal. Order from Curriculum and Instructional Materials Center, 1500 W. Seventh Avenue, Stillwater, OK 74074, phone 1-800-522-5810 ext. 589. Out-of-state, 1-800-654-4502.

Audiovisual Materials

- *Quality/Yield Grading of Beef Carcasses*, Slide film with script, 80 frames. Order No. F260, avaliable from Vo-AG Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801, phone (217) 333-3871.
- *Identification of Pork Cuts*, Slide film with script, 81 frames. F182a; *Identification of Beef Cuts*, Slide film with script, 96 frames. F183a; *Identification of Lamb Cuts*, Slide film with script, 47 frames. F185a, available from Vo-AG Service, College of Agriculture, University of Illinois, 1401 S. Maryland Drive, Urbana, IL 61801, phone (217) 333-3871.

UNIT REFERENCES

- Boggs, Donald L. and Robert A. Merkel, *Live Animal Carcass Evaluation and Meat Selection Manual*, Kendall/Hunt Publishing Co., Dubuque, Iowa, 1984.
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BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Science 466	Identifies	Definitions	
OBJECTIVE 2	Language Arts 191	Evaluates	Information-written	Validity
OBJECTIVE 3	Language Arts 039	Collects/ Organizes	Information-oral/written	Classifications
	Science 345	Describes/ Explains	Matter	Uses
OBJECTIVE 4	Language Arts 137	Comprehends	Information-written	Comparisons/ contrasts
	Science 474	Identifies	Matter	Physical properties
	Science 466	Identifies	Definitions	
OBJECTIVE 5	Science 306	Describes/ Explains	Human/animal	Skeletal systems
	Language 038	Collects/ Organizes	Information-oral/written	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 6	Language 039	Collects/ Organizes	Information-oral/written	Classifications
	Science 306	Describes/ Explains	Human/animal	Skeletal system
	Science 037	Applies/Uses	Classifications schemes	
OBJECTIVE 7	Science 037	Applies/Uses	Classifications schemes	
OBJECTIVE 8	Science 342	Describes/ Explains	Matter	Physical properties
	Language Arts 092	Composes/ Edits	Reports/essays	Information supplying
OBJECTIVE 9	Language Arts 039	Collects/ Organizes	Information-oral/written	Classifications
OBJECTIVE 10	Science 342	Describes/ Explains	Matter	Physical properties
OBJECTIVE 11	Mathematics 015	Calculates/ Evaluates	Percent markup/	In/decrease, discount
	Mathematics 127	Converts	Word problems expressions	Mathematical
	Mathematics 233	Solves Problems	Proportion	Weight
	Mathematics 261	Uses Calculator	Addition	
	Mathematics 262	Uses Calculator	Division	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
	Mathematics 266	Uses Calculator	Multiplication	
	Mathematics 268	Uses Calculator	Subtraction	
	Language Arts 035	Attends	Directions/task	
OBJECTIVE 12	Language Arts 023	Applies/Uses	Study habits/	Skimming
	Language Arts 038	Collects/ Organizes	Information-oral/written	
	Language Arts 035	Attends	Directions/task	
	Science 037	Applies/Uses	Classifications schemes	

MEAT PRODUCTS

OBJECTIVE 1

Match terms associated with meat products to their correct definitions.

- **Bloom**—The desired bright red color of beef or lamb resulting from the meat chemically mixing with oxygen
- **Conformation**—The skeletal and muscular build of the animal
- **Cull**—To remove or take out; implies lack of quality
- **Curing**—A treatment for meat and meat products to enhance preservation and taste by rubbing curing agents such as salt and sugar into the meat or by soaking the meat in an agent-containing liquid
- **Cutability**—The amount of usable lean in a carcass
- **Dressing percentage**—The percentage of the carcass that is usable meat

  NOTE: The percentage is equal to the chilled carcass weight divided by live weight times 100.
- **Feathering**—The fat distributed between the ribs
- **Fresh products**—"Raw" meats
- **Marbling**—The distribution of fat in the lean
- **Meat**—The muscle of an animal
- **Meat by-products**—Nonfood animal products such as fat, hides or wool, bone, and hormones, or edible products other than meat such as heart, liver, and tongue
- **Primal cut**—The initial, large sections a carcass is divided into; sometimes called wholesale cuts
- **Smoking**—A treatment for meat and meat products to enhance preservation and taste by exposing the product to smoke

OBJECTIVE 2 **Select from a list true statements about the eating quality of meat.**

Meat is one of man's favorite foods. While it may seem that only our sense of taste is excited by meat, research has shown that other senses also come into play, and may be even more important to our enjoyment of meat.

The sense of smell is not well understood yet, but research seems to indicate that smell is a powerful factor in the pleasure we experience when eating meat. The smell of meat activates our digestive system, and sets off hunger pangs. Think of your own response to bacon frying in the morning, pork chops frying, or a Thanksgiving turkey roasting in the oven. Research has also shown that people unable to smell the meat they are eating do not enjoy it as much and that scents similar to those of meat but caused by other items, do not have the same effect.

The sense of sight is also an important factor in our appreciation of meat. Certainly the sight of a steak broiled in our favorite way sets off a much different reaction than the sight of a raw steak or a burned steak.

Taste, however, remains the sense we rely upon when eating meat. Research into what makes meat taste good is an important part of the meat industry. Tenderness and juiciness have been proven to be important factors in good-tasting meat. These factors are influenced by marbling, age of the animal, cut, and method of cooking.

Most of the research is done by taste testing panels. These randomly chosen people taste various pieces of meat and rate them for such things as tenderness, juiciness, etc.

Meat is also good for us. While it is not required for survival, it is a rich source of nutrition. Three ounces of beef supply 45% of the protein, 31% of the iron, 28% of the zinc, and 17-47% of the various B vitamins needed daily by an adult male. Recent trends toward leaner meat make it more nutritious than ever.

OBJECTIVE 3

List types of meat by-products and three common products derived from each one.

When we think of livestock, we think of meat. Actually, however, we get a large variety of products from livestock. Hooves, fat, internal organs, even hormones are used. In the industry, it is commonly said that "everything is used but the moo." The list below is just a sample of uses for by-products.

- **Hooves**
  - Asphalt
  - Insulation
  - Linoleum
  - Paint and varnish
  - Phonograph records
  - Cosmetics
  - Shaving cream
  - Waterproofing
  - Cement
  - Textiles
  - Fabric softeners
  - Matches
- Fats
  - Fats and grease for human consumption
  - Fats for animal consumption
  - Tallow for candles
  - Leather treatments
  - Lubrication oils
  - Synthetic rubber
  - Polishes and floor waxes
  - Soap
  - Glue and adhesives
  - Crayons
- **Meat, bone, blood meal**
  - Animal feeds
  - Fertilizer

- **Hides and skins**
  - Leather for shoes, sports equipment, etc.
  - Wool for clothing
  - Edible gelatin (pork)
- Casings (intestines, stomach, bladder, etc.)
  - Sausage containers
  - Strings for musical instruments
  - Strings for tennis rackets
  - Surgical ligatures
- Pharmaceutical and diagnostic by-products
  - Replacement therapy (hormones such as insulin)
  - Drug substances
  - Diagnostic tools (such as TSH for diagnosing thyroid disorders)

    NOTE: Chemicals produced by animal systems will cause similar effects in human systems, so they may be used to diagnose certain diseases.

  - Tools for research
  - Use in vaccine manufacture
- **Edible organs**
  - Heart
  - Liver
  - Tongue
  - Tripe
  - Brains

OBJECTIVE 4

List forms of meat available to consumers.

Consumers can purchase meat in three basic forms: fresh, cooked, and smoked/cured.

- **Fresh meat** is raw. It may be preserved through freezing, refrigeration, or vacuum-packing.

- **Cooked meat** has been exposed to heat to facilitate preservation. Many lunchmeats have been cooked, as have many ready-to-eat frozen or canned meats. In many cases, cooked meat is preserved with gravy to prevent a loss of flavor.

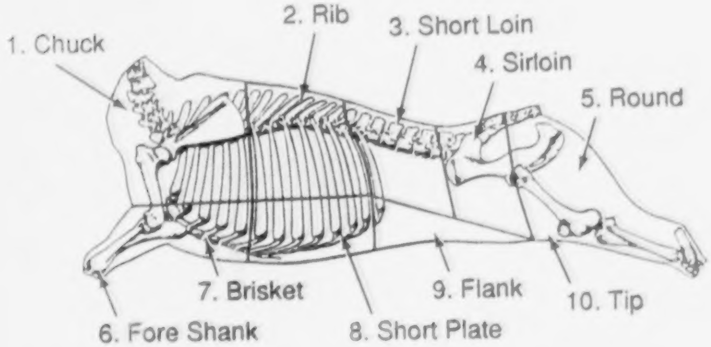
- **Smoked or cured meat** has been preserved through chemical means. Smoked meat is exposed to smoke or treated with "liquid smoke." Cured meat has been soaked in a liquid containing agents such as salt or sugar or has had these agents rubbed into the meat. These processes are now done primarily for taste and appearance rather than preservation.

OBJECTIVE 5

Label the basic wholesale (primal) cuts of beef, pork, and lamb.

- Beef

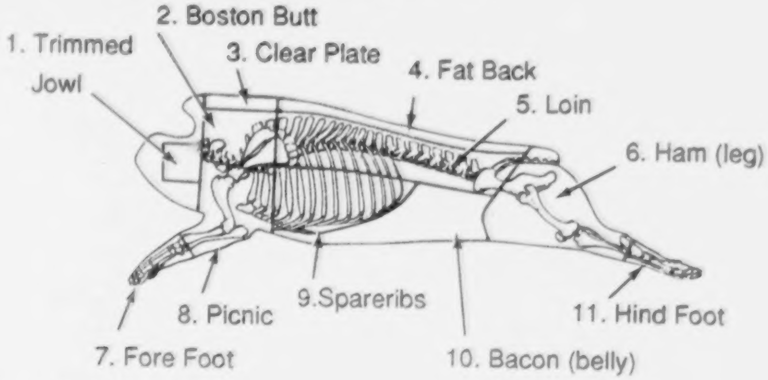
  Beef is divided into eight primal cuts. From these, hundreds of retail cuts may be taken. Note the skeletal landmarks on each cut line.



NOTE: Beef is first cut in half lengthwise along the backbone (sides) then sometimes into quarters (forequarter and hindquarter) before being further divided into these primal cuts.

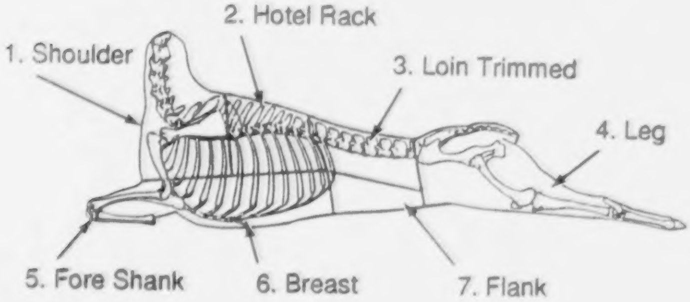
- Pork

Pork is divided into eleven primal cuts. The feet are shown here as two cuts, but are not separated after being cut from the carcass. The fat back and clear plate are also shown as two cuts, but are used with other fat from the carcass rather than as cuts of meat. So, even though there are eleven initial primal cuts, only nine cuts or sets of cuts are processed. Note skeletal landmarks along cut lines.


1. Trimmed Jowl
2. Boston Butt
3. Clear Plate
4. Fat Back
5. Loin
6. Ham (leg)
7. Fore Foot
8. Picnic
9.Spareribs
10. Bacon (belly)
11. Hind Foot

- Lamb

Lamb is divided into seven primal cuts. No division is drawn between the fore shank and breast, and they are still considered two separate primal cuts.


1. Shoulder
2. Hotel Rack
3. Loin Trimmed
4. Leg
5. Fore Shank
6. Breast
7. Flank

NOTE: Like beef, lamb is sometimes divided in half before primal cuts are made. Unlike beef and pork, it is sometimes the front portion of the carcass that is referred to as the "foresaddle;" the rear portion as the "hindsaddle."

OBJECTIVE 6 **Name the primal cut from which retail cuts are taken.**

Primal cuts may be divided into many different retail cuts. These cuts are then sold in markets and restaurants or are further processed. The amount of fat on the cut, the quality and tenderness of the piece, and consumer preference determine which retail cuts are made. The charts on the following pages do not list all possible cuts, but indicate some common retail cuts and their primal beginnings.

Many retail cut names include the primal cut, such as "sirloin steak," center loin," or "leg chop." Retail cuts can also be traced to the primal cut by the bones included in the cut. See Supplement 1 for bones that identify groups of retail cuts.

NOTE: Ground beef is carcass meat, usually from the chuck, round, short plate, or flank. Hamburger may contain other meat products. Processed meats and wieners are made from meat removed from bones and other by-products.

Beef

- Round
  - Round steak
  - Top round roast
  - Top round steak
  - Boneless rump roast
  - Bottom round roast
  - Tip roast, cap off
  - Eye round roast
  - Tip steak
- Sirloin
  - Sirloin steak, flat bone
  - Sirloin steak, round bone
  - Top sirloin steak
- Fore Shank and Brisket
  - Shank cross cut
  - Brisket, whole
  - Corned brisket, point half
  - Brisket, flat half

- Chuck
    - Chuck eye roast
    - Boneless top blade steak
    - Arm pot roast
    - Boneless shoulder roast
    - Cross rib roast
    - Mock tender
    - Under blade pot roast
    - 7-Bone pot roast
    - Short ribs
    - Flanken-style ribs
- Short loin
    - T-Bone steak
    - Boneless top loin steak
    - Tenderloin roast
    - Porterhouse steak
    - Tenderloin steak
- Rib
    - Rib roast, large end
    - Rib roast, small end
    - Rib eye roast
    - Rib eye steak
    - Back ribs
- Flank and short plate
    - Flank steak
    - Flank steak rolls
    - Skirt steak
- Other cuts
    - Ground beef
    - Beef for stew
    - Cubed steak
    - Cubes for kabobs

Pork

- Leg/Ham
  - Leg cutlet
  - Smoked ham center slice
  - Canned ham
  - Sliced ham
  - Top leg (inside) roast
  - Smoked ham
  - Smoked ham shank portion
  - Smoked ham rump portion
  - Boneless smoked ham
- Shoulder
  - Blade roast
  - Boneless blade roast
  - Boneless arm picnic roast
  - Blade steak
  - Smoked shoulder roll
  - Smoked hocks
  - Smoked picnic
- Loin
  - Country-style ribs
  - Center rib roast
  - Sirloin roast
  - Boneless sirloin
  - Sirloin cutlet
  - Tenderloin
  - Blade roast
  - Crown roast
  - Blade chop
  - Top loin chop
  - Sirloin chop
  - Back ribs
  - Boneless blade roast
  - Smoked loin chop
  - Rib chop
  - Loin chop

  - Butterfly chop
  - Top loin roast (double)
  - Center loin roast
  - Canadian-style bacon

- Side

  - Spareribs
  - Sliced bacon

- Other cuts

  - Cubes steak
  - Cubes for kabobs
  - Pork pieces
  - Ground pork
  - Sausage links

Lamb

- Leg

  - Whole leg
  - Short cut leg, sirloin off
  - Shank portion roast
  - Center leg
  - Center slice
  - American-style roast
  - Frenched-style roast
  - Boneless leg roast
  - Hind shank
  - Sirloin chop
  - Boneless sirloin roast

- Loin

  - Loin Roast
  - Loin chop
  - Double loin chop

- Foreshank and Breast
    - Shank
    - Spareribs
    - Boneless rolled breast
    - Riblets
- Rib
    - Rib roast
    - Rib chop
    - Frenched rib chop
    - Crown
- Shoulder
    - Square-cut shoulder, whole
    - Presliced shoulder
    - Boneless shoulder roast
    - Neck slice
    - Blade chop
    - Arm chop
- Other cuts
    - Lamb for stew
    - Cubes for kabobs
    - Ground lamb

OBJECTIVE 7 **Arrange in order beef and lamb quality grades.**

Beef and lamb are subject to two types of grades: yield or cutability, and quality. Quality refers to the desirability of the meat. Beef quality grades are based on age, marbling, color, external fat, firmness, and texture of the lean. Quality grades in lamb are based on feathering (the distribution of fat between the ribs), fat streaking in the flank, fullness and firmness of the flank, and conformation of the carcass.

Cows (female bovine that have had one or more calves), cannot be given the quality rating of prime. Bulls and stags (male bovine which have been castrated after reaching sexual maturity) cannot be given the quality rating of prime and in these two cases, the ratings "Select" and "Standard" have been combined to form the "Good" rating.

Prime beef is used in hotels and restaurants; Choice and Select are available in grocery stores; and Standard, Commercial, Utility, Cutter and Canner are used in processed meat and cheaper ground meat.

- **Beef Quality Grades:**
  - Prime
  - Choice
  - Select
  - Standard
  - Commercial
  - Utility
  - Cutter
  - Canner
- **Lamb Quality Grades:**
  - Prime
  - Choice
  - Good
  - Utility
  - Cull

OBJECTIVE 8

Discuss beef and lamb yield grades.

- Yield (cutability) refers to the amount of usable lean in the carcass.
- Yield grades in beef and lamb are #1–#5 with #1 meaning the greatest amount of usable meat and #5 the least.
- Beef Grades are determined by a formula based on
  - Carcass weight
  - Rib eye area
  - Fat thickness
  - Percentage of kidney, pelvic and heart fat
- Lamb yield grades are based upon
  - The amount of fat over the 12th rib
  - The amount of kidney and pelvic fat
  - The conformation of the leg

OBJECTIVE 9

List pork grades.

Pork is given a grade by combining the quality and yield grades given beef and lamb. The grade is based on carcass size, marbling, color, firmness, and moistness or dryness of the meat.

- Pork
  - U.S. #1
  - U.S. #2
  - U.S. #3
  - U.S. #4
  - Utility
  - Cull

NOTE: #1 is the highest pork grade, cull is the lowest.

OBJECTIVE 10

List average and normal slaughter weights for beef, pork, and lamb.

- Beef:
  Average 1150 lb
  Normal 900-1400 lb

- Pork:
  Average 240 lb
  Normal 190-265 lb

- Lamb:
  Average 110 lb
  Normal 90-140 lb

OBJECTIVE 11

Select from a list elements found on a meat label.

NOTE: These elements are not required by law but are recommended by USDA.

- Primal cut

- Retail cut

  NOTE: Names of retail cuts are standardized by the Uniform Retail Meat Standards program. Presently, over 315 "official" names are listed. Use of standardized names is voluntary; cuts can be called by any name.

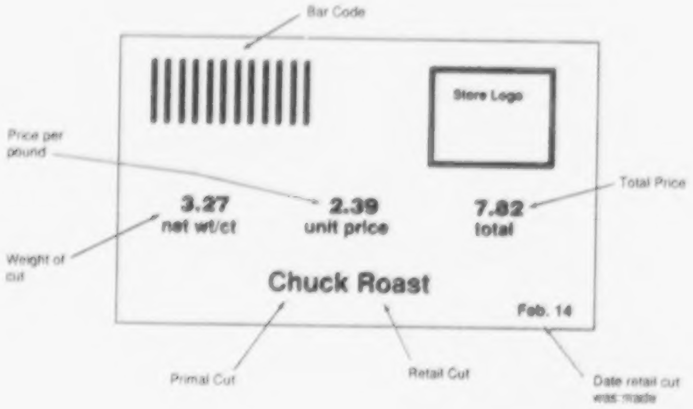
- Price per pound

- Weight of cut

- Total cost (price per pound x weight of cut)

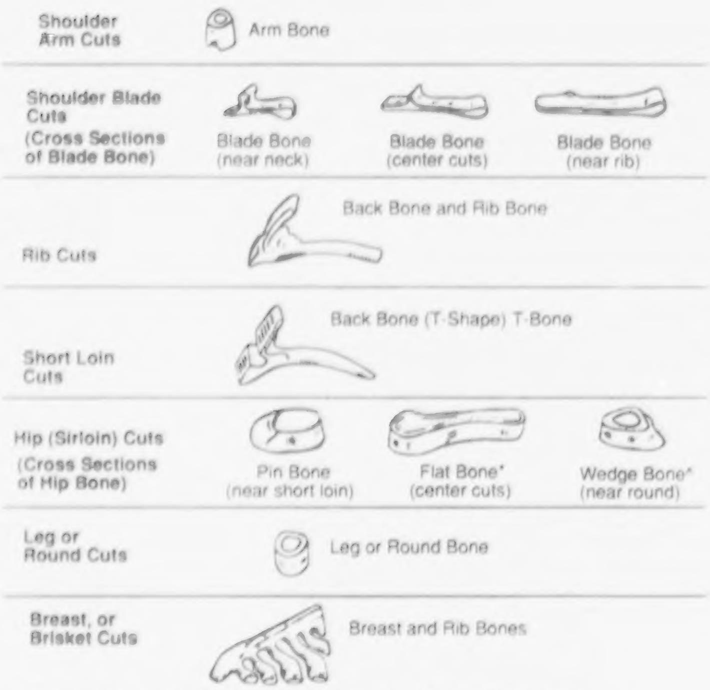
- Added ingredients

- Date retail cut was made.


Bar Code
Store Logo
Price per pound
3.27
net wt/ct
2.39
unit price
7.82
total
Total Price
Weight of cut
Chuck Roast
Feb. 14
Primal Cut
Retail Cut
Date retail cut was made

BONES THAT IDENTIFY SEVEN GROUPS OF RETAIL CUTS

BONES IDENTIFY SEVEN GROUPS OF RETAIL CUTS


Shoulder Arm Cuts
Arm Bone
Shoulder Blade Cuts (Cross Sections of Blade Bone)
Blade Bone (near neck)
Blade Bone (center cuts)
Blade Bone (near rib)
Rib Cuts
Back Bone and Rib Bone
Short Loin Cuts
Back Bone (T-Shape) T-Bone
Hip (Sirloin) Cuts (Cross Sections of Hip Bone)
Pin Bone (near short loin)
Flat Bone* (center cuts)
Wedge Bone^ (near round)
Leg or Round Cuts
Leg or Round Bone
Breast, or Brisket Cuts
Breast and Rib Bones

*Formerly part of "double bone" but today the bone is usually removed leaving only the "flat bone" (sometimes called "pin bone") in the sirloin steak.

^On one side of sirloin steak, this bone may be wedge shaped while on the other side the same bone may be round.

CAREERS IN MEAT PRODUCTS

Chicken shaped like drumsticks, round, square, and rectangular boneless fish patties, and "boneless" ribs are all common meats. yet, these are not natural meats—they are products of the meat preservation field.

Research into the slaughter, processing, preservation, and chemical makeup of meat are all busy fields. These careers require advanced university study.

Careers in research into the growth of the animal themselves, also continue to expand. Leaner, larger, healthier animals have resulted from research in animal science and genetics. These also require advanced study. Additional research continues into new uses of by-products and methods of reducing loss.

In the field, processing, butchering, and inspection careers require various levels of university study, and vocational training.

NAME ______________________________ SCORE _______

OBJECTIVE 13 **Calculate the cost of processing at a locker plant.**

INTRODUCTION Meat purchases account for almost 5% of the average family's spendable income. Because it is such a sizable expense, many people consider purchasing an animal and having it processed at the local locker plant. Comparing the cost of doing so with the cost of purchasing meat at the market is not as simple as it may seem. The cost of slaughter and processing must include adjustments for fat and bone and the cost of special processing.

Step 1 List needed information.

- Price per pound charged for processing
- Slaughter fees
- Live weight of the animal
- Cost or value of animal

Step 2 Determine the hanging weight.

- Multiply the live weight of the carcass by 60%.
- The answer is the approximate dressed weight.

Step 3 Adjust for trimming.

- Multiply dressed weight by 20%.
- Subtract answer from dressed weight.
- The answer is the amount of trimmed, ready-to-cook meat.

Step 4 Calculate the price per pound of processing.

- Multiply the dressed weight by the per pound processing fee.
- Add the kill fee.

- Add the cost of special processing (weight of meat to be tenderized, etc. x per pound fee for special processing).
- Add cost or value of the animal.
- Divide total by the answer to Step 3 (total ready-to-cook meat in pounds).

PROBLEM Mr. Stephens has a feeder cow he plans to have slaughtered. He believes its market value would be $924.00. It currently weighs 1200 lbs. His local market charges $15.00 per head kill fee, $.25 per pound processing fee, and $.15 per pound for special processing. What would he actually pay per pound if 30 pounds of meat received special processing?

Step 1 List needed information.

Price per pound charged for processing ____________________

Slaughter fees ____________________

Live weight of the animal ____________________

Cost or value of animal ____________________

Step 2 Determine the hanging weight.

Step 3 Adjust for trimming.

Multiply dressed weight by 20%. ____________________

Subtract answer from dressed weight. ____________________

Step 4 Calculate the price per pound of processing.

Multiply the dressed weight by the per pound processing fee. ____

Add the kill fee. ____________________

Add the cost of special processing (weight of live meat x special processing fee). ____________________

Add cost or value of the animal. ____________________

Divide total pounds of ready-to-cook meat. ____________________

ASSIGNMENT SHEET 2

MEAT PRODUCTS

III

NAME ______________________________ SCORE _______

OBJECTIVE 14

Survey types of meat found locally.

INTRODUCTION

You may not have realized how many types of meat products were available until you started working on this unit. Now that you know what to look for, this assignment asks that you read newspaper advertisements to find how many varieties of meats, byproducts, and other meat-related products can be found in your area on a daily basis.

You will need:

- Notebook
- Pencil or pen
- Local newspapers

DIRECTIONS

1. Title the first page of your notebook "Meats."
2. Title the second page of your notebook "By-products."
3. Title the third page of your notebook "Surprises."
4. Survey local newspapers, listing every product you see advertised which is a meat product or meat by-product.
5. List meats on the "Meats" page.
6. List by-products on the "By-products" page.
7. List any you are unfamiliar with, such as meats you have never eaten, or did not consider a meat product, such as crayons, which are derived from a meat by-product, on the "Surprises" page.

ASSIGNMENT SHEET 1

Step 1

$.25

$15.00

1200 pounds

$924.00

Step 2

1200 x .60 = 720 pounds

Step 3

.20 x 720 = 144 pounds

720 - 144 = 576 pounds

Step 4

720 x .25 = $180.00

180 + 15 = $195.00

30 x .15 = $4.50
195 + 4.50 = $199.50

199.50 + 924 = $1125.50

1125.50 ÷ 576 = $1.95

ASSIGNMENT SHEET 2

Check that students

- Found a variety of meats.
- Found a variety of meat by-product based items.
- Recognized at least three surprises.

WRITTEN TEST

MEAT PRODUCTS

III

OBJECTIVE 1

Match terms associated with meat products to their correct definitions. Write the correct letters in the blanks.

____ 1. The desired bright red color of beef or lamb resulting from the meat chemically mixing with oxygen

____ 2. The amount of usable lean in a carcass

____ 3. "Raw" meats

____ 4. Non-food animal products such as fat, hides or wool, bone, hormones and edible products other than meat such as heart, liver, and tongue

____ 5. A treatment for meat and meat products to enhance preservation and taste by exposing the product to smoke

____ 6. The distribution of fat in the lean

____ 7. The fat distributed between the ribs

____ 8. A treatment for meat and meat products to enhance preservation and taste by rubbing curing agents such as salt and sugar into the meat or by soaking the meat in an agent-containing liquid

____ 9. The muscle of an animal

____ 10. The initial, large sections a carcass is divided into; sometimes called wholesale cuts

____ 11. To remove or take out; implies lack of quality

____ 12. The skeletal and muscular build of the animal

____ 13. The percentage of the carcass that is usable meat

a. ribbing
b. smoking
c. cutability
d. meat by-products
e. retail cut
f. curing
g. fresh products
h. grade
i. marbling
j. meat
k. tenderness
l. bloom
m. feathering
n. conformation
o. primal cut
p. cull
q. dressing percentage
r. quality
s. yield grade
t. muscling

OBJECTIVE 2

Select from a list true statements about eating quality of meat. Write an "X" in front of true statements about the eating quality of meat.

____ 1. Taste, sight, and smell are all stimulated by meat.

____ 2. Taste is influenced by tenderness and juiciness.

____ 3. Only the sense of taste is activated by meat.

____ 4. The digestive system is not stimulated until meat is actually eaten.

____ 5. The body responds to meat before it is eaten.

____ 6. Research into taste is an important part of the meat industry.

____ 7. A person who cannot smell the meat he is about to eat will enjoy his meat as much as the person who can.

____ 8. Most research is based on computerized computations.

____ 9. Researchers learn most of their information by conducting taste tests.

____ 10. The enjoyment of meat can begin with the smell of meat cooking.

____ 11. Meat is eaten only for taste, not nutrition.

____ 12. Meat contains large amounts of protein, iron, zinc, and B-vitamins.

OBJECTIVE 3

List types of meat by-products and common products derived from each one. Write the names of three by-products and products derived from them in the space below.

1. ____________________ ____________________

____

____

2. ____________________ ____________________

____

____

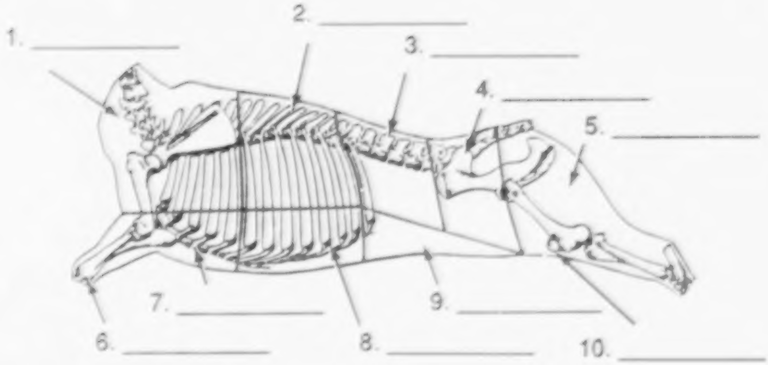
____

3. ____________________

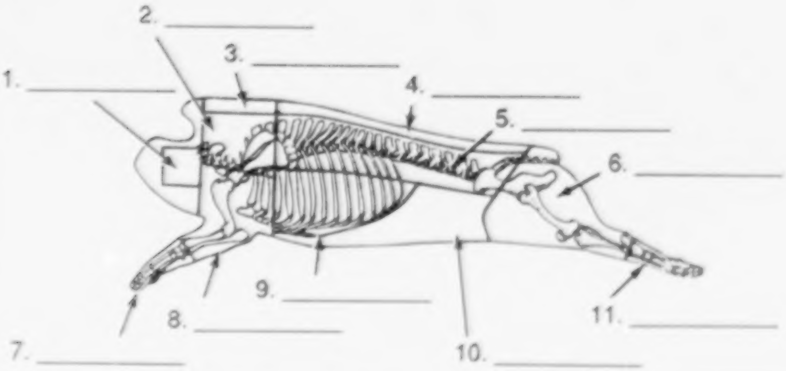
OBJECTIVE 4 **List forms of meat available to consumers.**

OBJECTIVE 5 **Label the basic wholesale (primal) cuts of beef, pork, and lamb.**

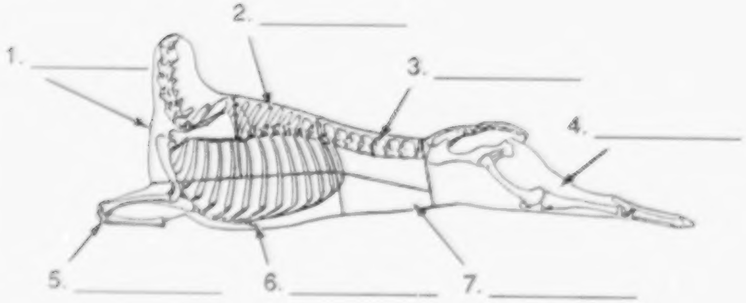
Beef:



Pork:



Lamb:



OBJECTIVE 6

Name the primal cut from which retail cuts are taken. Write the name of the primal cut each retail cut is taken from in the blank provided.

Lamb

1. Hind shank ____________________
2. Rib roast ____________________
3. Sirloin chop ____________________
4. Boneless rolled breast ____________________
5. Loin roast ____________________
6. Arm chop ____________________

Pork

1. **Boneless arm picnic roast** ______________________________
2. **Bacon** ______________________________
3. **Back ribs** ______________________________
4. **Spareribs** ______________________________
5. **Ham** ______________________________
6. **Blade roast** ______________________________

Beef

1. Chuck eye roast ______________________________
2. T-bone steak ______________________________
3. Skirt steak ______________________________
4. Rib eye steak ______________________________
5. Rump roast ______________________________
6. Tip roast ______________________________

OBJECTIVE 7

Arrange in order beef and lamb quality grades. Place a "1" in front of the highest quality grade, a "2" in front of the next grade, etc.

______ Standard

______ Prime

______ Choice

______ Canner

______ Commercial

______ Cutter

______ Select

______ Utility

______ Utility

______ Good

______ Cull

______ Choice

______ Prime

OBJECTIVE 8 **Discuss beef and lamb yield grades.**

1. What does yield refer to?

2. What are the beef and lamb grades?

3. What is the highest grade in beef and lamb?

4. Name three criteria for determining beef grades.

5. Name three criteria for determining lamb grades.

OBJECTIVE 9 **List pork grades.**

OBJECTIVE 10

List average and normal slaughter weights for beef, pork, and lamb.

Beef:

Average ____

Normal ____

Pork:

Average ____

Normal ____

Lamb:

Average ____

Normal ____

OBJECTIVE 11

Select from a list information found on a meat label. Write an "X" in front of elements you would normally find on a meat label.

____1. Length of ageing

____2. Cost per pound

____3. Primal cut

____4. Age of animal

____5. Weight of cut

____6. Weight of animal

____7. Date of retail cutting

____8. Amount of fat over 12th rib

____9. Name of retail cut

___10. Total cost

___11. Dressing percentage

___12. Amount of marbling

NOTICE	The following assignment sheets are not a part of the written test. If these activities have not been completed, check with your instructor.
OBJECTIVE 12	**Calculate cost of processing at a locker plant.** SCORE ________
OBJECTIVE 13	**Survey types of meat products found locally.** SCORE ________

WRITTEN TEST ANSWERS

MEAT PRODUCTS

III

OBJECTIVE 1

1. l
2. c
3. g
4. d
5. b
6. i
7. m
8. f
9. j
10. o
11. p
12. n
13. q

OBJECTIVE 2

1, 2, 5, 6, 9, 10

OBJECTIVE 3

List may include any 3 of the 6 categories (fats; edible organs; meat, bone, and blood meal; hides and skins; casings; and pharmaceutical/diagnostic (medical) products). Examples may be any of those listed in the Information Sheet, any that were noted in class, or any other accurate example.

OBJECTIVE 4

Answer should include the following:

- Fresh
- Cooked
- Smoked or cured

OBJECTIVE 5

Beef:

1. Chuck
2. Rib
3. Short Loin
4. Sirloin
5. Round
6. Fore Shank
7. Brisket
8. Short Plate
9. Flank
10. Tip

Pork:

1. Trimmed Jowl
2. Boston Butt
3. Clear Plate
4. Fat Back
5. Loin
6. Ham (Leg)
7. Fore Foot
8. Picnic
9. Spareribs
10. Bacon (Belly)
11. Hind foot

Lamb:

1. Shoulder
2. Hotel Rack

3. Loin Trimmed
4. Leg
5. Fore Shank
6. Breast
7. Flank

OBJECTIVE 6

Lamb

1. Leg
2. Rib
3. Leg
4. Breast
5. Loin
6. Shoulder

Pork

1. Shoulder
2. Side
3. Loid
4. Side
5. Ham or leg
6. Loin

Beef

1. Chuck
2. Short loin
3. Short plate
4. Rib
5. Round
6. Round

OBJECTIVE 7

Beef Quality:

4

1

2

8

5

7

3

6

Lamb Quality:

4

3

5

2

1

OBJECTIVE 8

Discussion should include:

1. Yield (cutability) refers to the amount of usable lean in the carcass
2. Beef and lamb yield grades are #1-#5.
3. #1 means greatest amount of lean; #5 the least.

At lease three criteria of each grade:

4. Beef: carcass weight, ribeye area, fat thickness, percentage of kidney, pelvic, and heart fat
5. Lamb: fat over 12th rib, kidney and pelvic fat, leg conformation

OBJECTIVE 9

#1, #2, #3, #4, Utility, and Cull

OBJECTIVE 10	**Beef:** Average — 1150 lbs Normal — 900-1400 lbs **Pork:** Average — 240 lbs Normal — 190-265 lbs **Lamb:** Average — 110 lbs. Normal — 90-140 lbs
OBJECTIVE 11	2, 3, 5, 7, 9, 10
OBJECTIVE 12	Refer to Answers to Assignment Sheet 1.
OBJECTIVE 13	Refer to Answers to Assignment Sheet 2.

OBJECTIVE SHEET

POULTRY PRODUCTS

IV

INTRODUCTION

Between 1955 and 1987, Americans tripled their consumption of chicken and turkey from 26 to 78 pounds per person. Since the late 1970's poultry products have experienced a tremendous amount of change and demand. The poultry processing industry is ever-changing due to the increase in demand and the many new processing and marketing techniques. This unit provides a base of information regarding poultry products and the poultry processing industry.

UNIT OBJECTIVE

Upon completion of this unit, the student should be able to identify parts of ready-to-cook poultry, the classes of poultry products, and grades of eggs. The student should also be able to compare the cost of poultry products based on grade and amount as well as candle eggs and calculate cost per serving of poultry products. The student will demonstrate these competencies by completing an assignment sheet, job sheet and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

Upon completion of this unit, the student should be able to

1. Match terms associated with poultry products to their correct definitions.
2. Choose the word or phrase that best completes statements about poultry inspection and grading.
3. Label the common poultry cuts and the body region from which they are cut.
4. List the leading poultry products producing states.
5. List two classes of ready-to-cook poultry for each species.
6. Choose the word or phrase that best completes statements about grading shell eggs.
7. Match egg sizes to their minimum required weight per dozen (ounces).
8. List common poultry products.
9. List common egg products.

10. Identify items generally found on poultry product labels.

11. Identify the forms of USDA identification for ready-to-cook poultry.

12. List poultry by-products and their uses.

13. Compare egg prices. (Assignment Sheet 1)

14. Demonstrate the ability to candle eggs. (Job Sheet 1)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

- Invite a USDA extension agent to provide a demonstration of candling and poultry grading.

- Obtain candling light for use with Job Sheet 1. The Economy Candler is available from Val-A for approximately $20. The address is Val-A, 700 West Root St., Chicago, IL, 60609, phone (312-927-7442).

- An effective home-made egg candler can be constructed by cutting a hole approximately one inch in diameter in one end of a 64 ounce juice can. Glue a small piece of felt around the hole to protect the egg from any sharp edges. Place a 60 watt light bulb in the can, mold aluminum foil around it to hold it in place and mount on a stand.

  WARNING: When the light is turned on the can will become very hot. Care should be taken that it is not touched or allowed to come into contact with any flammable materials.

- The illustration of the egg air cell gauge in Job Sheet 1 can be photocopied and mounted on an index card. Carefully cut out the three indicators. The gauge can now be used to determine the size of the air cell while candling.

- Arrange for a tour of a poultry processing plant in your area.

DELIVERY

Objective 1

- Poll the class for definitions of the terms associated with poultry products.

- Write the responses on the chalkboard or overhead.

Objective 2

- Invite a local poultry grader to discuss the ways that poultry carcasses are graded and inspected.

- Bring poultry carcasses of each class to show the difference in grades.

- Invite a grocer or butcher to discuss and demonstrate the differences in carcasses with Grades A, B, and C.

- Point out that as our society continues to grow and advance in technology, so does the poultry processing industry. To keep up with the innovative ideas of processors, the equipment manufacturers must continue to develop new equipment to process these new poultry products.

- Have students use periodicals, newsletters, manufacturing catalogs, etc. to list new poultry products and processing technology. Present your findings to the class. Use photos, illustrations or other visual aids to help present your findings.

Objective 3

- After covering this objective, bring various poultry cuts to class and quiz the class on the origin of those cuts.

  NOTE: Be sure to include such parts as the giblets.

Objective 4

- Poll class for the top poultry products processing states.

Objective 5

- Use the table to explain that poultry includes more than just chicken and turkey.

- Poll the class to see who has eaten or seen poultry products other than turkey and chicken.

Objective 6

- Discuss what a grader looks for when determining the grade of shell eggs.

- Show samples of each grade of shell eggs.

Objective 7

- Bring samples of the different shell egg sizes for each USDA minimum weight requirement.

- Have students bring examples of each size from home.

  NOTE: You may wish for the students to hard boil the eggs before bringing the eggs to school. This will help alleviate any "accidents" in the school.

Objective 8

- Poll class for additional common poultry products that are not listed in the objective. Have students write three of the most popular on the lines below those stated in the objective.

Objective 9

- Show samples of the common egg products as mentioned in the list.

- Poll class for additional egg products that fall under this category.

Objective 10

- Bring examples of poultry product labels to class and distribute them among the class.

- Have students bring labels from home to compare the items listed.

Objective 11

- Invite a local USDA poultry inspector and grader to discuss the various forms of USDA identification for ready-to-cook poultry products as well as [illegible] cooked and other poultry products.

- Obtain samples of the tags and stamps that are used in inspecting and grading poultry products.

Objective 12

- Use current data on the new by-products in the poultry products industry to supplement this list.

- Invite a representative from a local poultry processor (or processing equipment company) to discuss the new poultry processing products and technology.

APPLICATION

Objective 13

- Have students complete Assignment Sheet 1 to help them realize the costs involved in pricing poultry products.

- Encourage students to visit each type of business listed in the assignment sheet if possible.

Objective 14

- Use Job Sheet 1 to give students hands-on experience with candling.

EVALUATION

Practical Test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.

- Describe the rating scale used on the practical test.

- Give practical test.

- Reteach and retest as necessary.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Audiovisual Materials

- *Egg Grades: A Matter of Quality*, 12 min., sound, color film, USDA, 1976. Description of the egg industry from controlled egg laying hens to assembly line packaging, quality control and shipping. Available for rent from Instructional Media Services, Washington State University, Pullman, Washington 99164-5602, phone (509)-335-4535, or (509)-335-5618. Order by title.

Publications

- *Poultry-Grading Manual*, Agriculture Handbook Number 31, United States Department of Agriculture, Washington, D.C., 1989.
- *Egg-Grading Manual*, Agriculture Handbook Number 75, United States Department of Agriculture, Washington D.C., 1983.

NOTE: These manuals may be obtained by writing Standardization Branch, Poultry Division, AMS, USDA, Room 3944-South, P.O. Box 96456, Washington D.C., 20090-6456 or by calling (202) 447-2356.

UNIT REFERENCES

- Gillespie, James R., *Modern Livestock & Poultry Production*, Delmar Publishers, Inc., Albany, New York, 1983.
- Hendrickson, Robert L., *Meat, Poultry, and Seafood Technology*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1978.
- Mountney, George J. and Carmen R. Parkhurst, *Poultry Meat and Egg Production*, Van Nostrand Reinhold Company, New York, 1988.
- *Poultry-Grading Manual*, United States Department of Agriculture, Washington D.C., 1989.
- *Egg-Grading Manual*, United States Department of Agriculture, Washington D.C., 1983.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using ***The Basic/Essential Skills Taxonomy***, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	**VERB**	**LINK A**	**LINK B**
OBJECTIVE 1	Science 466	Identifies	Definitions	
OBJECTIVE 2	Science 308	Describes/ Explains	Human/animal	Tissues
	Science 474	Identifies	Matter	Physical properties
	Language Arts 191	Evaluates	Information-written	Validity
OBJECTIVE 3	Science 306	Describes/ Explains	Human/animal	Skeletal system
OBJECTIVE 4	Free Enterprise 074	Describes/ Explains	Economic interdependence	
	Language Arts 038	Collects/ Organizes	Information-oral/written	
OBJECTIVE 5	Language Arts 136	Comprehends	Information-written	Charts/graphs/ tables
	Language Arts	Collects/ Organizes	Information-written	Classifications

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 6	Language Arts 139	Comprehends	Information-written	Context
	Science 466	Applies/Uses	Definitions	
	Science 474	Identifies	Matter	Physical properties
	Language Arts 136	Comprehends	Information-written	Charts/tables/ graphs
	Language Arts 190	Evaluates	Information-written	Validity
OBJECTIVE 7	Science 467	Identifies	Definitions	Operational
	Science 477	Identifies	Measurement units	
	Science 037	Applies/Uses	Classification schemes	
OBJECTIVE 8	Language 038	Collects/ Organizes	Information-oral/written	
	Science 344	Describes/ Explains	Matter	Uses
OBJECTIVE 9	Language Arts 038	Collects/ Organizes	Information-oral/written	
	Science 344	Describes/ Explains	Matter	Uses
OBJECTIVE 10	Language Arts 166	Describes/ Explains	Purpose/ strategy	Word groups

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 11	Free Enterprise 092	Describes/ Explains	Government impact	Regulations
	Language Arts 145	Comprehends,	Information-written	Purpose
OBJECTIVE 12	Language Arts 038	Collects/ Organizes	Information-oral/written	
	Science 344	Describes/ Explains	Matter	Uses
OBJECTIVE 13	Free Enterprise 124	Identifies	Cost factors	Pricing
	Mathematics 097	Constructs	Charts/tables/ graphs	
	Science 046	Applies/Uses	Scientific methods	Data gathering qualitative
	Science 045	Applies/Uses	Scientific methods	Analysis quantitative
OBJECTIVE 14	Language Arts 035	Attends	Directions/task	
	Science 037	Applies/Uses	Classification schemes	
	Science 040	Applies/Uses	Laboratory techniques	
	Science 042	Applies/Uses	Maps/charts/ tables	
	Science 044	Applies/Uses	Scientific methods	

LOCAL POULTRY PROCESSORS

Poultry or egg processing facilities are found in most areas of the country. Although you may not be aware of it, there may be one nearby that you can visit or contact for information. Although your area may or may not have poultry processors, your local grocers may do some processing with ready-to-cook poultry. This activity will allow you to make valuable contact with those processors in your area.

DIRECTIONS List the poultry processors in your area using the form below.

NOTE: You may wish to contact a regional poultry association to obtain names of poultry processors in your area.

Turkey Processors

____

____

____

____

____

____

Broiler Processors

____

____

____

____

____

____

Egg Processors

Other Poultry Products Processors

OBJECTIVE 1

Match terms associated with poultry products to their correct definitions.

- **Poultry**—Domesticated birds raised for eggs and/or meat
- **By-products**—Something produced in addition to the principal product

  EXAMPLE: Feathers
- **Candle**—To examine an egg for staleness, blood clots, fertility and growth by holding the egg between intense light and the human eye

Candling Eggs

- **Shell egg**—Raw egg in the shell from a domesticated chicken hen
- **Air cell**—The area at the large end of an egg where the inner shell membrane separates from the outer shell
- **Yolk**—The circular yellow mass of stored food that forms the inner portion of the egg that is surrounded by the egg white

- **Egg white**—A mass of protein material surrounding the yolk of an egg
- **USDA**—United States Department of Agriculture
- **Grading**—The classifying and sorting of poultry and poultry products according to various groups of conditions and quality characteristics
- **Grade**—A standard of food quality
- **Viscosity**—The resistance of liquid to flow

OBJECTIVE 2

Choose the word or phrase that best completes statements about poultry inspection and grading. (Supplement 1)

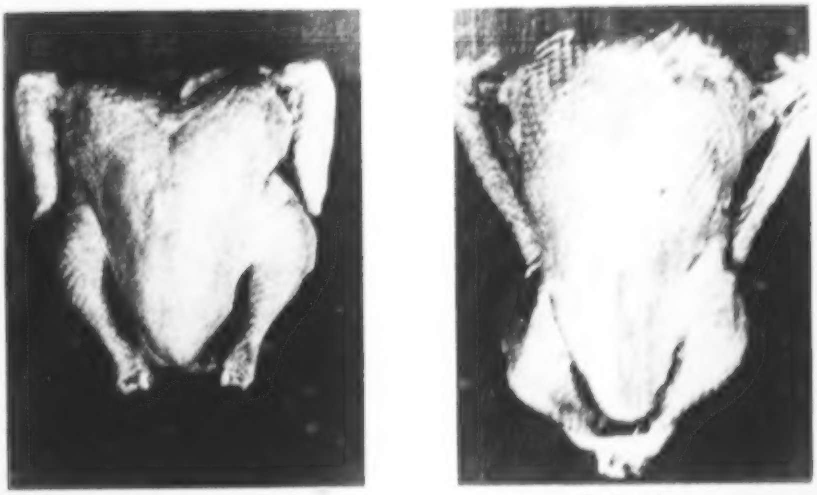
- Inspection is required by law. Grading is voluntary and is a service provided by the USDA and paid for by the processor.
- Voluntary grading is administered by the Poultry Division of the USDA's Agricultural Marketing Service. A resident grader is employed and licensed by the USDA to evaluate the quality of chicken and chicken products processed at the plant.
- Standards of quality reflect the relative degree of excellence in any live bird, called live grading; or in any ready-to-eat bird or its parts, called carcass grading. Carcass standards include:
  - A good proportion of meat to bone
  - Adequate skin covering
  - Adequate fat covering
  - Absence of pinfeathers
  - Absence of disjointed and broken bones
  - Absence of discolorations
- Grades are:

  U.S. Grade A — Highest quality, complete and without deformities

  U.S. Grade B — Moderate deformities, moderately fleshed, may be partially disjointed

  EXAMPLES: Two disjointed but not broken joints or one disjointed and one nonprotruding broken bone.

U.S. Grade C — Abnormal, poorly fleshed, lacking in fat, with broken bones, discolorations and missing parts

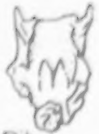


A Quality

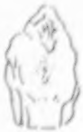
B Quality

Read-to-Cook Young Chickens

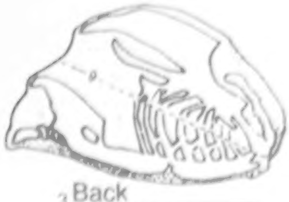
OBJECTIVE 3 **Label the common poultry cuts and the body region from which they are cut.**



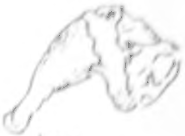
1 Rib



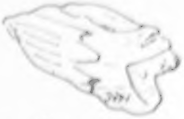
2 Back



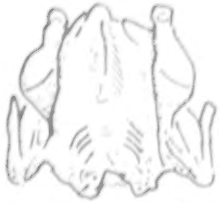
3 Back



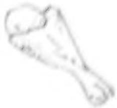
4 Leg



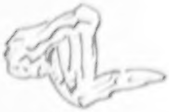
5 Breast



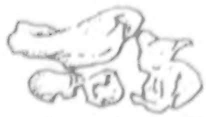
6 Whole Bird



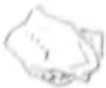
7 Drumstick



8 Wing



9 Miscellaneous Parts



10 Thigh

OBJECTIVE 4 **List the leading poultry products producing states.**

The most dynamic sector in poultry production is the broiler industry. Production grew from 34 million birds in 1934 to over 5 billion in 1987, or about 20 chickens for every man, woman, and child in the United States.

- Chicken
  - Georgia
  - Arkansas
  - Texas
  - Alabama
- Turkey
  - North Carolina
  - Minnesota
  - California
- Egg
  - California
  - Indiana
  - Pennsylvania
  - Georgia
- Other

OBJECTIVE 5

List two classes of ready-to-cook poultry for each species.

Classes of poultry are regulated by the USDA. Standards change as the technology of breeding and production improves time to maturity, size, and quality. The National Poultry Improvement Plan is working to include quail, pheasant and peacocks in the slaughter regulations.

Species	Class	Sex
Chicken	Rock Cornish game hen	Female
	Rock Cornish Fryer	Female
	Broiler or fryer	Either
	Roaster	Either
	Capon	Unsexed male
	Hen for stewing	Female
	Cock	Male
Turkey	Fryer-roaster	Either
	Young turkey	Either
	Yearling turkey	Either
	Mature or old	Either
Duck	Broiler duckling	Either
	Roaster duckling	Either
	Mature or old	Either
Goose	Young	Either
	Mature or old	Either
Guinea	Young	Either
	Mature or old	Either
Pigeon	Squab	Either
	Pigeon	Either

OBJECTIVE 6

Choose the word or phrase that best completes statements about grading shell eggs. (Job Sheet 1)

- Shell eggs are graded on exterior and interior quality. The exterior quality considers factors that are apparent from direct observation, such as shell shape and texture, soundness (whether the shell is cracked), and how clean it is.

- Interior quality involves the contents of the egg as they appear before a candling light or when the eggs are broken and measured. Interior quality considers the air cell, white and yolk.

- Air cell—Only the depth is considered.

  NOTE: Air cell depth is a U.S. standard measure and the easiest quality factor to evaluate. It is determined with an egg air cell gage as shown in Job Sheet 1.

- Yolk—Graded on the distinctness of the shadow outline in candling, the size and shape, defects, and germ development.

  NOTE: The germ is a single cell that develops into the yolk. Germ development affects the color and whether the yolk has blood in it, and has some bearing on fat, oil and viscosity of the yolk.

- White—(Albumin) Graded on viscocity and clarity.

OBJECTIVE 7

Match egg sizes to their USDA required minimum weight per dozen (ounces).

Jumbo	30 oz
Extra Large	27 oz
Large	24 oz
Medium	21 oz
Small	18 oz
Peewee	15 oz

OBJECTIVE 8

List common poultry products.

Between 1955 and 1987, Americans tripled their consumption of chicken and turkey, from 26 to 78 pounds per person.

In 1955, poultry represented about 16 percent of total meat consumption, while in 1987 its share had more than doubled to 34 percent. Whole frying chicken prices were higher in 1955 than those for ground beef. However, improved technology and mechanization made products available at lower prices, and in 1987 the price for whole frying chickens had been reduced to nearly 1/2 the price of a pound of ground beef.

Through the 1980s, the development and introduction of many new poultry products, which reduce preparation time and put poultry in front of consumers in many forms, also favorably affected poultry consumption.

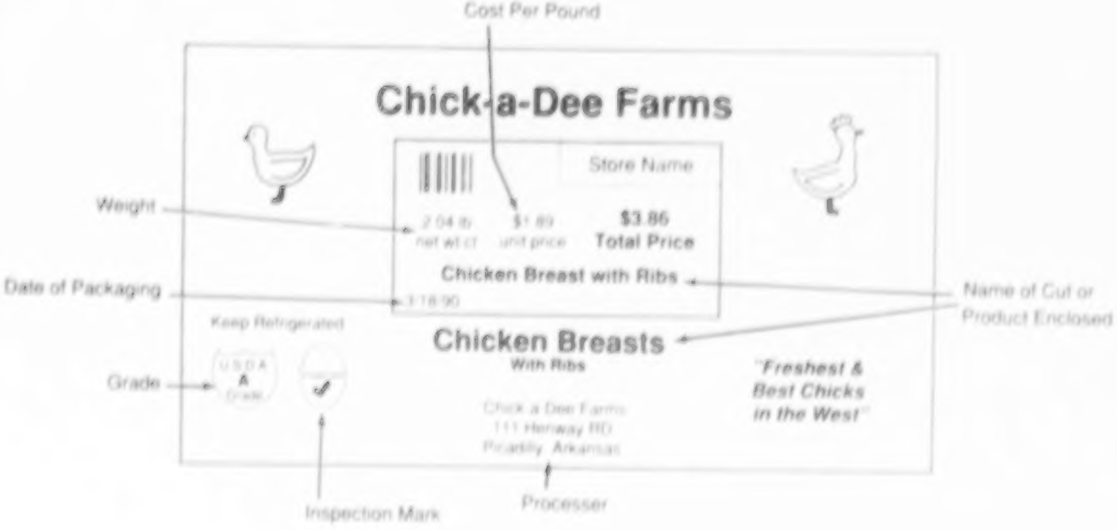
- Ready-to-cook poultry
- Nuggets
- Ham
- Bologna
- Sticks
- Franks
- Filets
- Patties

OBJECTIVE 9 List common egg products.

- Shell eggs
- Liquid/frozen eggs
- Dried eggs
- Dehydrated eggs

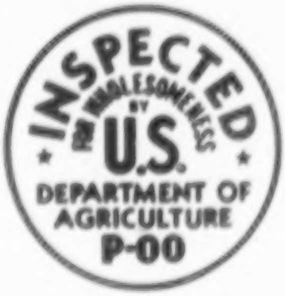
OBJECTIVE 10 **Identify items generally found on poultry product labels.**

The processor sends packaged goods to the grocer, who weighs the package and prices it according to local prices. The grocer then adds the store label to the processor's label.

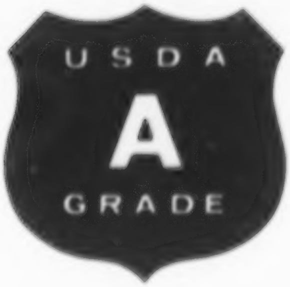

Cost Per Pound
Chick-a-Dee Farms
Store Name
Weight
2.04 lb
net wt ct
$1.89
unit price
$3.86
Total Price
Chicken Breast with Ribs
Date of Packaging
3/18/90
Name of Cut or Product Enclosed
Keep Refrigerated
Chicken Breasts
With Ribs
Grade
USDA
A
Grade
"Freshest & Best Chicks in the West"
Chick a Dee Farms
111 Henway RD
Picadilly, Arkansas
Inspection Mark
Processer

OBJECTIVE 11 **Identify the forms of USDA identification for ready-to-cook poultry.**

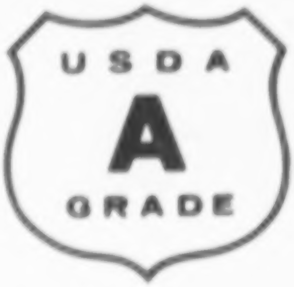
NOTE: Labels bearing the inspection mark and the grademark must be approved by USDA. Inspection labels do not imply quality, but insure that the products are fit for human consumption. The grade marks identify the quality.


INSPECTED
FOR WHOLESOMENESS
BY
U.S.
DEPARTMENT OF
AGRICULTURE
P-00

Inspection Mark


USDA
A
GRADE

Grade Mark


USDA
A
GRADE

Grade Mark

OBJECTIVE 12 **List poultry by-products and their uses.**

- Feathers—Used for clothing and animal feed
- Bone meal—Used for fertilizer and animal feed
- Feather meal—Used for feed and fertilizer
- Meat and bone scraps—Frozen and sold as dog food

OFFICIAL IDENTIFICATION MARKS

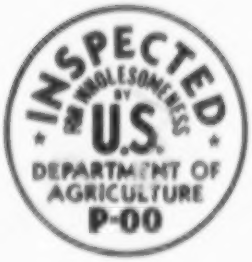

INSPECTED
FOR WHOLESOMENESS
BY
U.S.
DEPARTMENT OF
AGRICULTURE
P-00

Figure 1

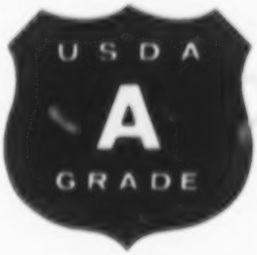

USDA
A
GRADE

Figure 2

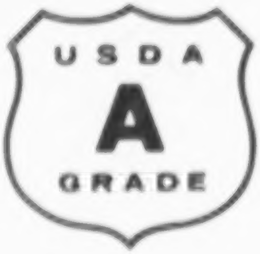

USDA
A
GRADE

Figure 3

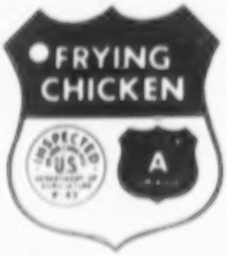

FRYING
CHICKEN
INSPECTED
U.S.
A

Figure 4

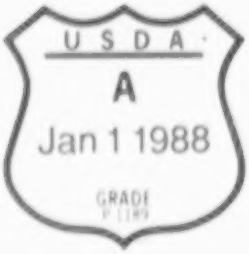

USDA
A
Jan 1 1988
GRADE
P 1189

Figure 5

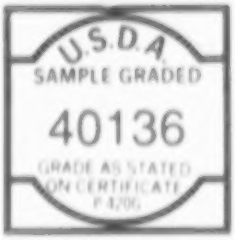

U.S.D.A.
SAMPLE GRADED
40136
GRADE AS STATED
ON CERTIFICATE
P 4206

Figure 6

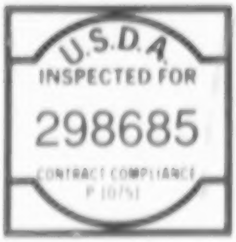
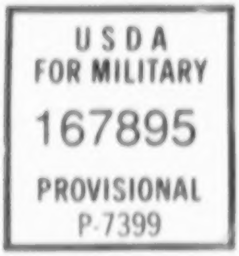

U.S.D.A.
INSPECTED FOR
298685
CONTRACT COMPLIANCE
P 10751

Figure 7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FOR MILITARY
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PROVISIONAL
P-7399

Figure 8

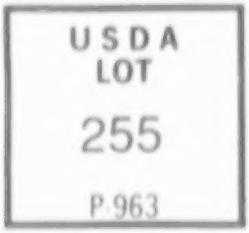

USDA
LOT
255
P-963

Figure 9

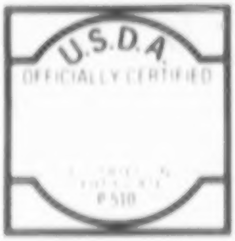

U.S.D.A.
OFFICIALLY CERTIFIED
P 510

Figure 10

See reverse for explanation of identification marks

The **inspection mark** (fig. 1) is required on consumer containers and shipping containers of poultry inspected under the Poultry Products Inspection Act.

Marks on Consumer Containers

The **grademark** must either be printed with light-colored letters on a dark field (fig. 2) or dark-colored letters on a light field (fig. 3).

Any **wing tag** (fig. 4), insert label, or other label which bears the inspection mark, the grademark, or both, must also show either the plant number or the firm name and address. When both marks are shown on a tag, they must appear on the same side of the tag, or they may appear on both sides of the tag. Wing tags of shield design may not be used to show both marks or the grademark only. Wing tags bearing the grademark must show the class of the product.

Marks on Shipping Containers

The **grademark** (fig. 5) is used on a container to designate a consumer grade. The date the product was graded shall be used in conjunction with the grademark when applied by stamping. Preprinted grademarks do.not require a date.

The **sample graded stamp** (fig. 6) is used when grade certification is made in conjunction with other factors, such as test weighing and temperature certification. This stamp may only be used when a certificate is actually issued and shall show the certificate number in the stamp. It is not used for condition certification of nongraded product for Puerto Rico.

The **contract compliance stamp** (fig. 7) is used when identifying product that has been produced according to approved specifications and is not to be applied until product is determined to be in compliance with all contract requirements. Either the certificate number or the date the product was certified may be used in the stamp, but the certificate number is preferred.

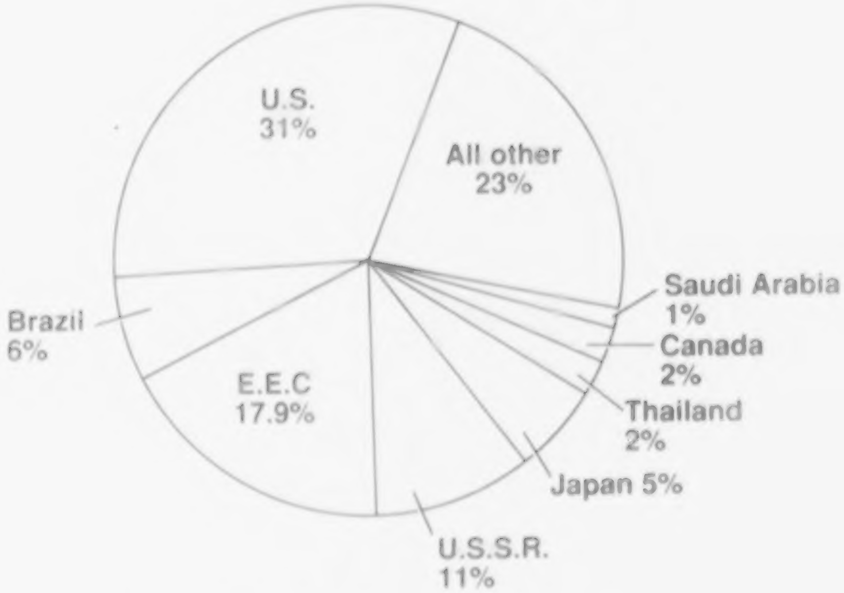
The **provisional stamp** (fig. 8) is used on poultry graded for military contracts for troop issue and/or resale when purchased under military "orders for subsistence." It is also to be used on Veterans Administration products when purchased on Defense Procurement Supply Center purchase contracts. The certificate number is in this stamp. It is to be applied at the time the product is determined to be compliance with all contract requirements.

The **lot stamp** (fig. 9) may be used to identify product that has been graded according to special purchase requirements, such as product for commodity purchase programs placed in a freezer until sufficient quantities accumulate for subsequent sale and delivery. It may also be used to identify further processed items produced according to approved specifications. The consecutive day of the year when the product was graded is in this stamp.

The **officially certified mark** (fig. 10) is used on poultry sampled for temperature, condition, weight, or other certifications where the grade is not referenced on the certificate or when product is not identified with an official grade. This stamp may be used only when a certificate is actually issued and shall show the certificate number in the stamp. It is used for condition certification of nongraded product for Puerto Rico.

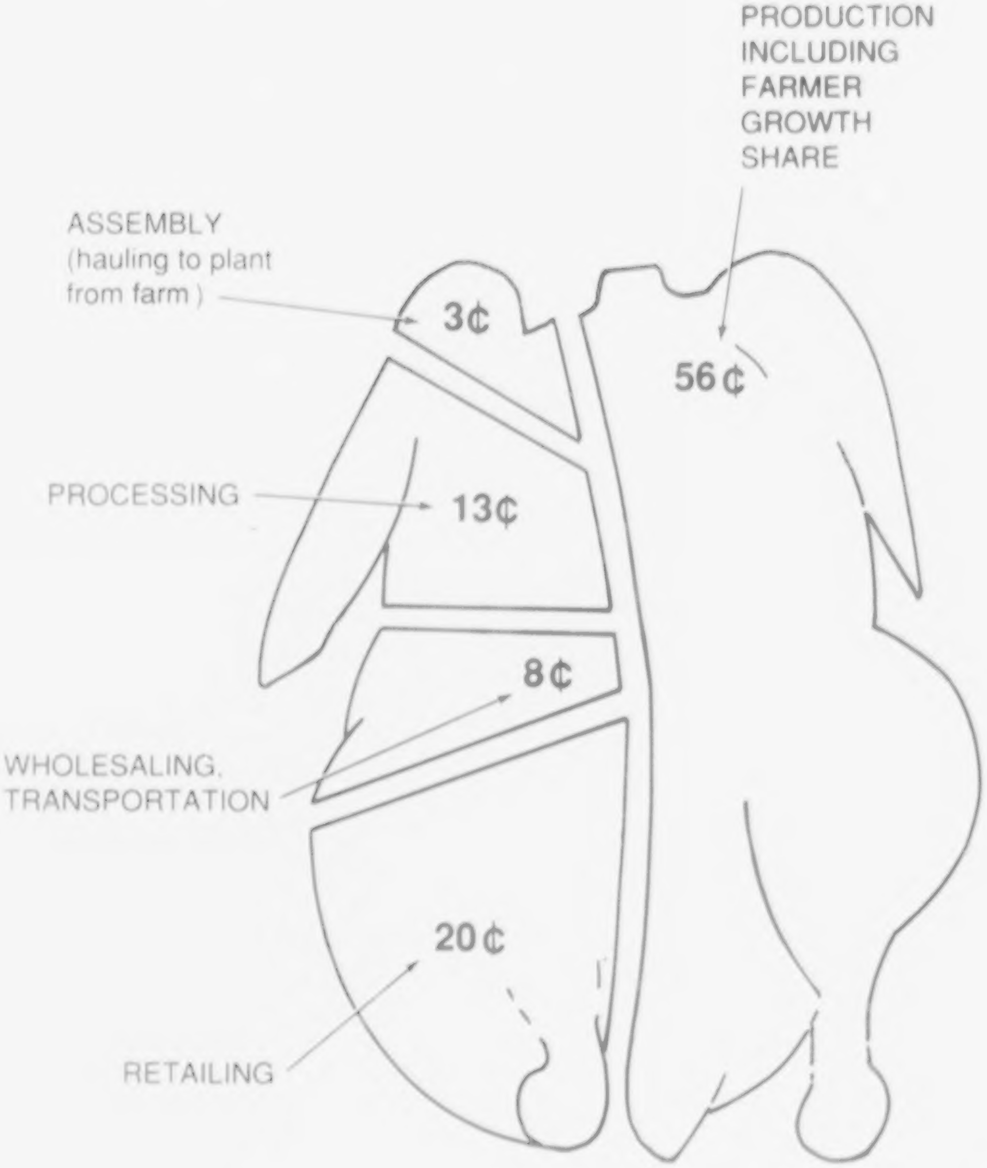
Global Poultry Meat Production 1989

Thousands of tons of poultry produced



*Eastern European Community
France
Federal Republic of Germany
Ireland
United Kingdom
Portugal
Spain
Greece
Denmark
Italy
Netherlands
Belgium
Luxembourg

What The Consumer Dollar Pays For



180

ASSIGNMENT SHEET 1

POULTRY PRODUCTS

IV

OBJECTIVE 13 Compare egg prices.

NAME ______________________________ SCORE ________

INTRODUCTION Since there are so many egg producers and types of shell eggs and egg products available, the egg product market has great diversity. In addition, due to the many retail markets that sell shell eggs and egg products such as dry and frozen eggs, the price of these products can vary from store to store.

DIRECTIONS Complete the following table by comparing the prices of shell eggs and egg products in two grocery stores, one convenience store, and two farms in your area (if possible). Write in the brand names of the frozen and dried products.

	Shell Eggs	Grocery Store #1	Grocery Store #2	Conven. Store #3	Farm #1	Farm #2
Grade AA	Jumbo					
	Extra Large					
	Large					
	Medium					
	Small					
	PeeWee					
Grade A	Jumbo					
	Extra Large					
	Large					
	Medium					
	Small					
	PeeWee					
Grade B	Jumbo					
	Extra Large					
	Large					
	Medium					
	Small					
	PeeWee					

	Shell Eggs	Grocery Store #1	Grocery Store #2	Conven. Store #3	Farm #1	Farm #2
Frozen/liquid eggs						
Dry egg products						

ASSIGNMENT SHEET 1

The answers will vary among students if your community has several different egg retailers. However, you will notice that the answers will be the same if your community has a limited amount of egg retailers. You may wish to extend the time for completing this assignment to allow students to compare egg prices in surrounding communities.

Evaluate the assignment on completion and report of findings.

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JOB SHEET 1

POULTRY PRODUCTS IV

OBJECTIVE 16

Candle eggs.

INTRODUCTION

Hand candling is used very little in present commercial grading operations. However, hand candling is still an excellent method for learning quality determination and is used for spot checking and determining accuracy in grading.

TOOLS AND EQUIPMENT

- Egg candling light
- Eggs
- Somewhat darkened room
- Separating bins for egg grades
- Egg air cell gauge

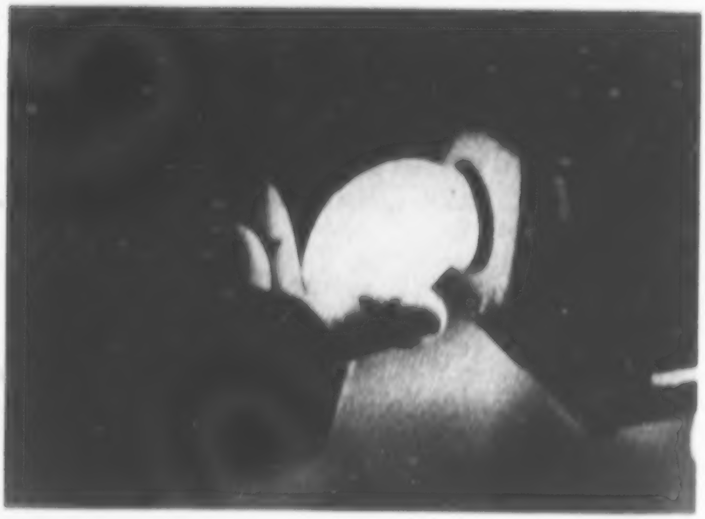
DIRECTIONS

1. Turn on the candling light.
2. Turn off or dim the room lights.
3. Pick up one egg.
4. Slightly twist your wrist as you hold the larger end of the egg toward the light.

   NOTE: It is very important that the yolk is spinning while candling the egg. The movement allows the person candling to better see the yolk and egg contents.

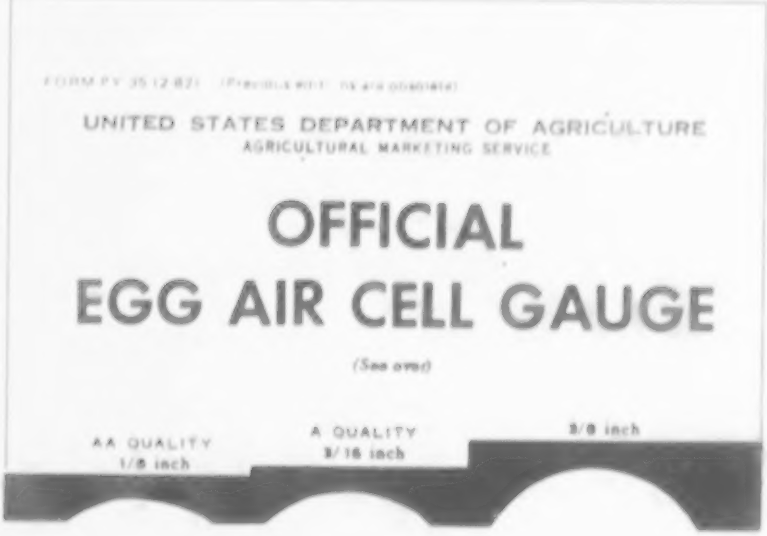
5. Hold the egg to the light. (Figure 1)

FIGURE 1



6. Use the official egg air cell gage to compare the air cell. The size of the air cells permitted in the various qualities is printed on the gauge. (Figure 2)

FIGURE 2



FORM PY 35 (2-82) (Previous editions are obsolete)

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

OFFICIAL
EGG AIR CELL GAUGE

(See over)

AA QUALITY
1/8 inch

A QUALITY
3/16 inch

3/8 inch

7. Place the eggs in the appropriate bins i.e. Grade AA, Grade A, or Grade B, (See chart below).

U.S. Standards, Grades, and Weight Classes for Shell Eggs

The U.S. standards, grades, and weight classes for individual shell eggs are applicable only to eggs of the domesticated chicken that are in the shell.

U.S. Standards for Quality of Individual Shell Eggs

(Based on Candled Appearance)

The standards described below are summarized in table 2.

AA quality — The shell must be clean, unbroken, and practically normal. The air cell must not exceed one-eighth inch in depth, may show unlimited movement, and may be free or bubbly. The white must be clear and firm so that the yolk is only slightly defined when the egg is twirled before the candling light. The yolk must be practically free from apparent defects.

A quality — The shell must be clean, unbroken, and practically normal. The air cell must not exceed three-sixteenths inch in depth, may show unlimited movement, and may be free or

Table 2. — Summary of U.S. Standards for quality of individual shell eggs

Quality Factor	Specifications for each quality factor		
	AA Quality	A Quality	B Quality
Shell	Clean Unbroken Practically normal	Clean Unbroken Practically normal	Clean to slightly stained.[*] Unbroken Abnormal
Air Cell	1/8 inch or less in depth Unlimited movement and free or bubbly	3/16 inch or less in depth Unlimited movement and free or bubbly	Over 3/16 inch in depth Unlimited movement and free or bubbly
White	Clear Firm	Clear Reasonably firm	Weak and watery Small blood and meat spots present.[**]
Yolk	Outline — slightly defined Practically free from defects	Outline — fairly well defined Practically free from defects	Outline — plainly visible Enlarged and flattened Clearly visible germ development but no blood Other serious defects

[*] Moderately stained areas permitted (1/32 of surface if localized, or 1/16 if scattered).
[**] If they are small (aggregating not more than 1/8 inch in diameter).

For eggs with dirty or broken shells, the standards of quality provide two additional qualities. These are:

Dirty	Check
Unbroken. Adhering dirt or foreign material, prominent stains, moderate stained areas in excess of B quality.	Broken or cracked shell but membranes intact, not leaking.[***]

[***] Leaker has broken or cracked shell and membranes, and contents leaking or free to leak.

8. Repeat the candling procedure as performed on the first egg.

9. Continue to candle eggs until you have candled 12 eggs (1 dozen).

10. Have instructor evaluate your work.

11. Put away your tools and equipment.

12. Clean up your work area.

JOB SHEET 1

Candle eggs.

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the material and try again.

The student:	YES	NO
1. Turned on the candling light.	_____	_____
2. Turned off or dimmed the room lights.	_____	_____
3. Picked up one egg.		
4. Slightly twisted the wrist as he or she held the larger end of the egg toward the light.	_____	_____
5. Held the egg to the light as in Figure 1.	_____	_____
6. Used the official egg air cell gauge to compare the air cell.	_____	_____
7. Placed the eggs in the appropriate bins i.e. Grade AA, Grade A, Grade B.	_____	_____
8. Repeated the candling procedure until 12 eggs were candled.	_____	_____
9. Used proper tools correctly.	_____	_____
10. Performed steps in a timely manner.	_____	_____
11. Practiced safety rules through procedure.	_____	_____
12. Provided satisfactory responses to questions asked.	_____	_____
13. Put away tools and cleaned work area.	_____	_____

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Handled eggs properly	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

POULTRY PRODUCTS

NAME ______________________________ SCORE ________

OBJECTIVE 1

Match terms associated with poultry products to their correct definitions. Write the letter of the correct answer in the blank.

____ 1. Domesticated birds raised for eggs and/or meat

____ 2. A standard of food quality

____ 3. The circular yellow mass of stored food that forms the inner portion of the egg that is surrounded by the egg white

____ 4. To examine an egg for staleness, blood clots, fertility and growth by holding the egg between intense light and the human eye

____ 5. Something produced in addition to the principal product

____ 6. The area at the large end of an egg where the inner shell membrane separates from the outer shell.

____ 7. United States Department of Agriculture

____ 8. A mass of protein material surrounding the yolk of an egg

____ 9. The resistance of liquid to flow

____ 10. Raw egg in the shell from a domesticated chicken hen

____ 11. The classifying and sorting of poultry and poultry products according to various groups of conditions and quality characteristics

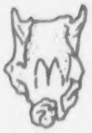
a. By-products
b. Grade
c. Shell egg
d. USDA
e. Air cell
f. FDA
g. Yolk
h. Air cell
i. Candle
j. Egg white
k. Viscosity
l. Poultry
m. Bovine
n. Grading
o. Thickness
p. Yellow

OBJECTIVE 2

Choose the word or phrase that best completes statements about poultry inspection and grading. Circle the correct answers. Some items may have more than one correct answer.

1. Standards of quality reflect _________ .
   - a. guidelines established by the USDA
   - b. the market price of the poultry
   - c. the relative degree of excellence
2. Grading is _________ .
   - a. required by law in some states
   - b. required by law in all states
   - c. voluntary
   - d. paid for by the USDA
3. Inspection is _________ .
   - a. voluntary
   - b. required by law
   - c. performed by a USDA employee
   - d. performed by an employee of the processing plant
4. Poultry carcasses are graded on all of the following criteria EXCEPT:_________
   - a. a good proportion of meat to bone
   - b. appropriate flavor
   - c. absence of disjointed and broken bones
   - d. adequate fat covering
   - e. absence of discolorations
   - f. absence of pinfeathers
   - g. adequate skin covering

OBJECTIVE 3 | **Label the common poultry cuts and the body region from which they are cut.**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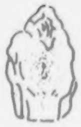
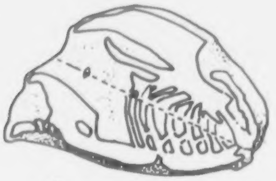

2. ______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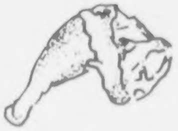
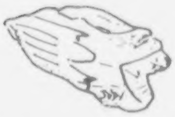
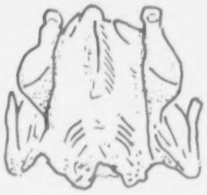
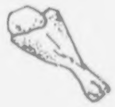
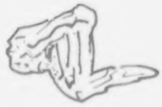
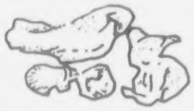

4. ______

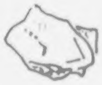

5. ______


6. ______


7. ______


8. ______


9. ______


10. ______

OBJECTIVE 4 | **List the leading poultry products producing states.**

Chicken

______

______

______

Turkey

______

______

______

Egg

____

____

____

Other

____

____

OBJECTIVE 5 **List two classes of ready-to-cook poultry for each species.**

Chicken

____

____

Turkey

____

____

Duck

____

____

Goose

____

____

Guinea

____

____

Pigeon

____

____

OBJECTIVE 6

Choose the word or phrase that best completes statements about grading shell eggs. Circle the correct answers. Some questions may have more than one correct answer.

1. In measuring the air cell, the only factor considered is_____ .
   a. width
   b. depth
   c. width and depth
   d. movement
2. Interior quality involves the contents of the egg as they appear _________ .
   a. before a candling light
   b. at different stages of development
   c. when the eggs are broken and measured
3. Exterior quality considers all of the following factors about the shell EXCEPT _________ .
   a. soundness
   b. cleanliness
   c. shape and texture
   d. inner smoothness
4. The white is graded on _________ .
   a. clarity
   b. shadow outline in candling
   c. viscosity
5. The yolk is graded on _________ .
   a. height
   b. distinctness of the shadow outline in candling
   c. size and shape
   d. color
   e. defects and germ development

OBJECTIVE 7

Match egg sizes to their minimum required weight per dozen (ounces). Write the letter of the correct answer in the blank.

____1. Jumbo

____2. Small

____3. Peewee

____4. Extra Large

____5. Medium

____6. Large

a. 21 oz

b. 27 oz

c. 10 oz

d. 18 oz

e. 24 oz

f. 23 oz

g. 15 oz

h. 30 oz

i. 16 oz

OBJECTIVE 8

List common poultry products. Write the name of five products in the space below.

____

____

____

____

____

OBJECTIVE 9

List common egg products. Write the name of five products in the space below.

____

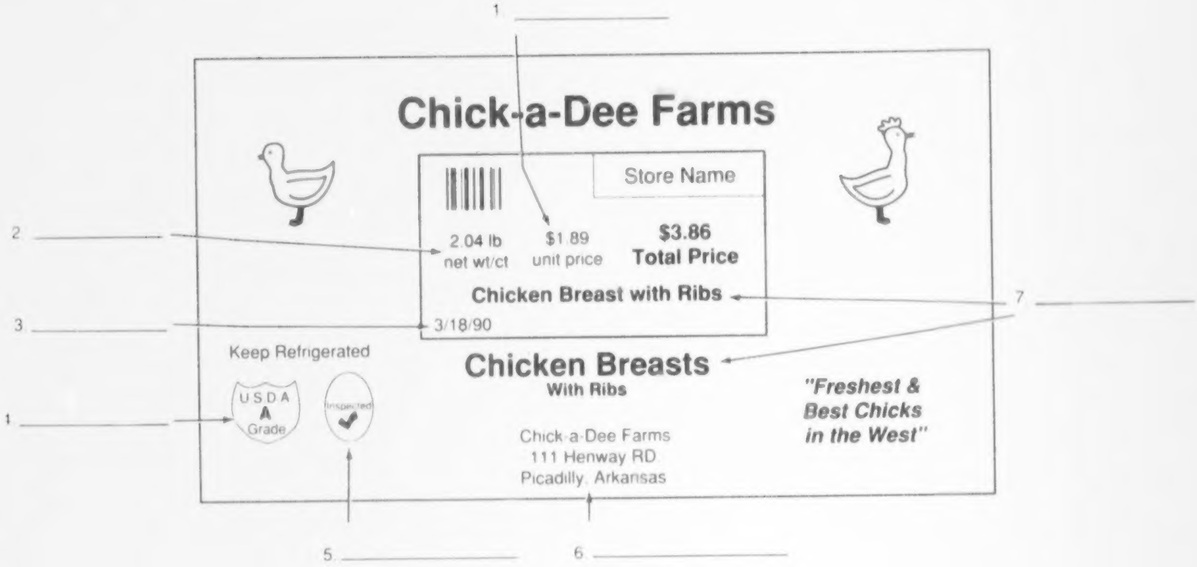
____

____

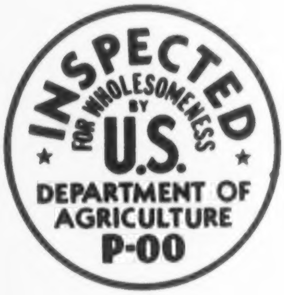
____

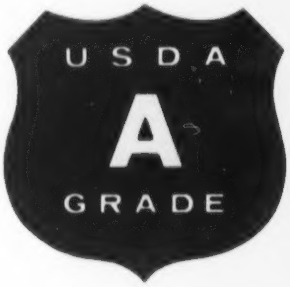
____

OBJECTIVE 10 | **Identify items generally found on poultry product labels.**


1. ____
Chick-a-Dee Farms
Store Name
2.04 lb
net wt/ct
$1.89
unit price
$3.86
Total Price
Chicken Breast with Ribs
2. ____
3. ____
3/18/90
7. ____
Keep Refrigerated
USDA
A
Grade
Inspected
Chicken Breasts
With Ribs
"Freshest & Best Chicks in the West"
4. ____
Chick-a-Dee Farms
111 Henway RD
Picadilly, Arkansas
5. ____
6. ____

OBJECTIVE 11 | **Identify the forms of USDA identification for ready-to-cook poultry.** Label the ID marks below as being either inspection marks or grademarks.


INSPECTED
FOR WHOLESOMENESS
BY
U.S.
DEPARTMENT OF
AGRICULTURE
P-00


USDA
A
GRADE

OBJECTIVE 12 **List poultry by-products and their uses.** Write three uses of by-products in the space below.

____

____

____

____

____

NOTICE: The following assignment sheets are not part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 13 Compare egg prices. SCORE ________

OBJECTIVE 14 Candle eggs. RATING ________

OBJECTIVE 1

1. l
2. b
3. g
4. i
5. a
6. h
7. d
8. j
9. k
10. c
11. n

OBJECTIVE 2

1. c
2. c
3. b, c
4. b

OBJECTIVE 3

1. Rib
2. Back
3. Back
4. Leg
5. Breast
6. Whole bird
7. Drumstick
8. Wing
9. Miscellanious parts
10. Thigh

OBJECTIVE 4

- Chicken
  - Georgia
  - Arkansas
  - Texas
  - Alabama
- Turkey
  - North Carolina
  - Minnesota
  - California
- Egg
  - California
  - Indiana
  - Pennsylvania
  - Georgia
- Other
  - Refer to your information sheet or notes regarding your defined "other"

OBJECTIVE 5

Answer may include any two of the following in each species:

- Chicken
  - Rock Cornish game hen
  - Rock Cornish fryer
  - Broiler or fryer
  - Roaster
  - Capon
  - Hen or Stewing
  - Cock
- Turkey
  - Fryer-roaster
  - Young turkey
  - Yearling turkey
  - Mature or old

- Duck
  - Broiler duckling
  - Roaster duckling
  - Mature or old
- Goose
  - Young
  - Mature or old
- Guinea
  - Young
  - Mature or old
  - Pigeon
  - Squab
  - Pigeon

OBJECTIVE 6

1. b
2. a, c
3. d
4. a, c
5. b, c, e

OBJECTIVE 7

1. h
2. d
3. g
4. b
5. a
6. e

OBJECTIVE 8

- Ready-to-cook poultry
- Nuggets
- Ham
- Bologna
- Sticks
- Franks
- Filets
- Patties

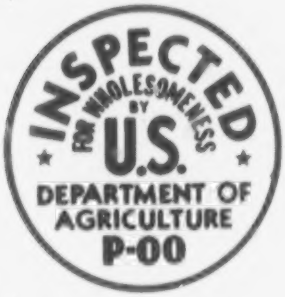
OBJECTIVE 9

- Shell eggs
- Liquid/frozen eggs
- Dried eggs
- Dehydrated eggs

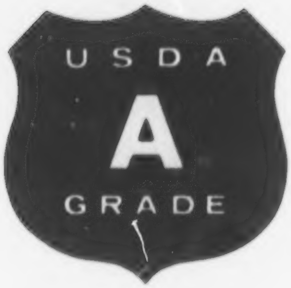
OBJECTIVE 10

2 Weight
1 Cost per pound
4 Grade
5 Inspection mark
3 Date of packaging
7 Name of cut or product enclosed
6 Processor

OBJECTIVE 11


INSPECTED
FOR WHOLESOMENESS
BY
U.S.
DEPARTMENT OF
AGRICULTURE
P-00

Inspection Mark


USDA
A
GRADE

Grade Mark

OBJECTIVE 12

- Feathers—Used for clothing and animal feed
- Bone meal—Used for fertilizer and animal feed
- Feather meal—Used for feed and fertilizer
- Meat and bone scraps—Frozen and sold as dog food

OBJECTIVE 13 Refer to answers to Assignment Sheet 1.

OBJECTIVE 14 Refer to Practical Test for Job Sheet 1.

OBJECTIVE SHEET

DAIRY PRODUCTS

V

INTRODUCTION

Milk and milk products are basic components of the human diet. Dairy products are economical sources of high quality protein, minerals and vitamins essential for proper growth and a long, healthful life.

UNIT OBJECTIVE

After completing this unit, the student will be able to name the components of dairy products, distinguish between the classes and grades of dairy products, and identify common flavor defects in milk. The student will demonstrate these competencies by completing the assignment sheets and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with the elementary study of dairy products to their correct definitions.
2. List the chemical components of milk.
3. Calculate the gross components of commercially sold whole milk.
4. Complete statements describing the nutritional value of milk for consumers.
5. Discuss characteristics of dairy products.
6. Distinguish between traditional and new dairy products.
7. Define real and artificial dairy products.
8. Define the grades of milk.
9. Arrange in order the steps in processing milk.
10. Arrange in order the steps in the manufacturing of cheese.
11. Arrange in order the steps in making ice cream.
12. Arrange in order the steps in buttermaking.
13. Differentiate between processing plant sanitation regulations and plant safety rules.

14. Determine cost per 100 calories of selected dairy products. (Assignment Sheet 1)
15. Compare labels of real and artificial dairy products. (Assignment Sheet 2)
16. Identify off-flavors in processed milk. (Assignment Sheet 3)
17. Evaluate selected cheeses. (Assignment Sheet 4)
18. Evaluate selected ice creams and ice milks. (Assignment Sheet 5)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

DELIVERY

Objective 1

- Introduce the general topic of dairy products and justify the time and effort to be spent (nutritional significance to consumers, economic benefits to dairy farmers, employment of workers in processing, transportation and sales of products).
- Explain briefly the production of milk on commercial dairy farms and its transportation to processing plants.
- Discuss the definitions of common terms.

Objectives 2 through 4

- Discuss the chemical composition of milk.
- Explain the factors that may affect the composition of milk as produced at the farm.

- Stress the gross milk component, percent solids-not-fat, because it is a key component of products manufactured from milk.

- Discuss the nutritional significance of milk for consumers.

Objective 5

- Demonstrate the major classes of dairy products by showing containers or packages (full or empty) of selected products from those listed (students could be asked to bring one or more empty containers or packages to illustrate variety).

- Explain how to interpret the information provided on packages or containers: calories, volume, weight.

- Illustrate calculation of the cost per pound or gallon of product. (One gallon of processed whole milk weighs 8.6 lbs. and there are 2 cups of milk in 1 pint.)

Objectives 6 and 7

- Using the samples from the foregoing demonstration (Objective 5), plus additional samples if needed, divide the samples into two groups to illustrate traditional and newer dairy products.

- Explain why consumers are changing their patterns of consumption of dairy products.

- Using appropriate samples of products, demonstrate the differences between real and artificial dairy products as indicated by the information label on each sample of each type of product.

Objective 8

- Discuss the differences in facilities and equipment used to produce grade A or grades B and C on the farm.

- Tell students that grade A raw milk must have not more than 100,000 bacteria per cc, while grade B milk may have not more than 1,000,000 bacteria per cc.

- Invite a State or County Health Department official to discuss milk and food sanitation regulations.

Objective 9

- Show Transparency Master 1 with flow diagram of processing steps and drawings of: clarifier, pasteurizer, homogenizer, and 2 filling machines (plastic and paper units).

Objective 10

- Show Transparency Master 2 with flow diagram of processing steps and drawings of: cheese vat filled with milk, addition of culture, addition of rennet, curd cutting, knitted curd, cut curd, curd press, curing cheese, and packaged cheese.

Objective 11

- Show Transparency Master 3 with flow diagram of processing steps and drawings of: mix vat, pasteurizer/ homogenizer, mix storage tank, continuous freezer, packaging machines, hardening room.

Objective 12

- Show Transparency Master 4 with flow diagram of processing steps and drawings of: cream separator, pasteurizer, churn, butter mass, cutting and packaging.

Objective 13

- Show Transparency Master 5 detailing the Dairy Plant Inspection Report used by the State Health Department.

APPLICATION

Objective 14

- Use Assignment Sheet 1 to teach students to recognize and evaluate various milk products and the different forms in which they are sold.
- Personally serve each student a small sample of the product; do not allow tasting until all students are served.
- Instruct students specifically on tasting procedure: do not swallow the sample, spit into sink, and rinse mouth with tap water.
- Discuss the organoleptic characteristics (flavor, aroma, texture) of each sample after each tasting.

Objective 15

- Go to a supermarket in advance and familiarize yourself with the array of real and artificial dairy products available.

- Arrange and conduct a field trip to the supermarket (minimum of 30 minutes on-site).

- Use Assignment Sheet 2 to teach students to distinguish between real and artificial dairy products.

- Note that students must complete Objective 5 and Objective 14 (Assignment Sheet 1) before completing Assignment Sheet 5.

Objective 16

- Use Assignment Sheet 3 to teach students to recognize and evaluate off-flavors in milk.

- Prepare several milks to demonstrate off-flavors (defects) by using a gallon of the best flavored processed milk available. Save 2 pints of it for Sample A & H (control, little or no defect; may have slightly cooked flavor).

  - Sample A: Control
  - Sample B: Flat, watery, lacking in flavor (add 10% water to a pint of milk)
  - Sample C: Salty (add 1 teaspoon of salt to a pint of milk).
  - Sample D: Cooked (heat a pint of milk to 200°F and cool as quickly as possible)
  - Sample E: Oxidized (place a pint of milk in glass in the sun for 30 minutes and then refrigerate).
  - Sample F: Acid (add 1/4 cup of buttermilk to 1 pint of milk).
  - Sample G: Disinfectant (add a few drops of chlorox bleach to a pint of milk).
  - Sample H: Control

- Personally serve each student a small sample of the product; do not allow tasting until all students are served; serve in the order shown above.

- Instruct students specifically on tasting procedure: do not swallow the samples, spit into sink, and rinse mouth with tap water.

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- Identify defects and discuss each sample after each tasting.
- Renumber prepared samples for a subsequent "blind" tasting practice by the students.

Objective 17

- Use Assignment Sheet 4 to teach students to recognize and evaluate various cheeses.
- Purchase several cheeses to demonstrate different types, flavors, and textures, for example, mild and sharp cheddar, processed cheese (plain), Gouda, Swiss, cottage cheese, Jack, Brick, etc.
- Personally serve each student a small sample of the product; do not allow tasting until all students are served.
- Instruct students specifically on tasting procedure: do not swallow the samples, spit in sink, and rinse mouth with tap water.
- Discuss the organoleptic characteristics of each sample after each tasting.

Objective 18

- Use Assignment Sheet 5 to teach students to recognize and evaluate various ice creams and ice milks.
- Purchase units of at least two ice creams and two ice milks.
- Supervise the making of a freezer of ice cream and one of ice milk as a classroom demonstration using the formulas shown.
    - "Homemade" ice cream may be made by mixing 2 quarts of "half-and-half," 1 quart of whole milk, 3 cups of sugar, and vanilla (or other) flavoring to taste; freeze in a home freezer to make about 1 gallon of product. Ice milk may be made by substituting whole milk for the "half-and-half."
- Personally serve each student a small sample of the product; do not allow tasting until all students are served.
- Instruct students specifically on tasting procedure: do not swallow the samples, spit into sink, and rinse mouth with tap water.

- Discuss the organoleptic characteristics of each sample after each tasting.

EVALUATION

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Publications

- *Dairy Technology and Engineering*, AVI Publishing Co., Inc., Harper and Hall, Westport, Connecticut.
- *The Science of Providing Milk for Man*, McGraw-Hill Book Co. New York.

UNIT REFERENCES

- *Dairy Technology and Engineering*, AVI Publishing Co., Inc., Harper and Hall, Westport, Connecticut.
- *Pasteurized Milk Ordinance 1985*, US Dept of Health and Human Services, Public Health Service, Food and Drug Administration, Washington, D.C.
- *The Science of Providing Milk for Man*, McGraw-Hill Book Co. New York.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Science 466	Identifies	Definitions	
OBJECTIVE 2	Language Arts 132	Comprehends	Information	
	Language Arts 038	Collects/ Organizes	Information- Oral/written	
OBJECTIVE 3	Science 085	Describes/ Explains	Carbon/ organic chemistry	
	Math 025	Computes	Addition	Complex numbers
	Math 083	Computes	Subtraction	Complex numbers
	Math 221	Solves problems	Percents	
	Math 127	Converts	Word problems	Mathematical expressions
OBJECTIVE 4	Science 102	Describes	Carbon/ organic chemistry	Vitamins

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 5	Science 100	Describes/ Explains	Carbon/ organic chemistry	Proteins
	Science 093	Describes/ Explains	Carbon/ organic chemistry	Fats
	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying
	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 6	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 7	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying
	Science 337	Describes/ Explains	Matter	
OBJECTIVE 8	Language Arts 132	Comprehends	Information-written	
	Language Arts 038	Collects/ Organizes	Information-Oral/written	
OBJECTIVE 9	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying
	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 10	Science 114	Describes/ Explains	Chemical reactions	
	Science 147	Comprehends	Information-written	Sequence
	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 11	Science 114	Describes/ Explains	Chemical reactions	
	Science 147	Comprehends	Information-written	Sequence
	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying
OBJECTIVE 12	Science 114	Describes/ Explains	Chemical reactions	
	Science 147	Comprehends	Information-written	Sequence
	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying
OBJECTIVE 13	Language Arts 092	Composes/ Edits	Reports/ essays	Information supplying
OBJECTIVE 14	Mathematics 042	Computes	Division	Mixed numbers
	Science 001	Analyzes/ Evaluates	Chemicals in society	
	Science 042	Applies/Uses	Maps/charts/ tables/graphs	
OBJECTIVE 15	Science 042	Applies/Uses	Maps/charts/ tables/graphs	
	Science 045	Applies/Uses	Scientific methods	Analysis-qualitative/ quantitative
	Science 046	Applies/Uses	Scientific methods	Data gathering

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 16	Science 042	Applies/Uses	Maps/charts/ tables/graphs	
	Science 045	Applies/Uses	Scientific methods	Analysis- qualitative/ quantitative
	Science 037	Applies/Uses	Classification schemes	
	Science 046	Applies/Uses	Scientific methods	Data gathering
OBJECTIVE 17	Science 042	Applies/Uses	Maps/charts/ tables/graphs	
	Science 045	Applies/Uses	Scientific methods	Analysis- qualitative/ quantitative
	Science 037	Applies/Uses	Classification schemes	
	Science 046	Applies/Uses	Scientific methods	Data gathering
OBJECTIVE 18	Science 042	Applies/Uses	Maps/charts/ tables/graphs	
	Science 045	Applies/Uses	Scientific methods	Analysis- qualitative/ quantitative
	Science 037	Applies/Uses	Classification schemes	
	Science 046	Applies/Uses	Scientific methods	Data gathering

OBJECTIVE 1

Match terms associated with the elementary study of dairy products to their correct definitions.

- **Cream**—A milk product with a concentrated (high) level of milk fat
- **Homogenized milk**—Pasteurized milk that has been mechanically treated to keep the milkfat dispersed throughout the milk
- **Lactose**—Milk sugar
- **Low fat milk**—Milk from which some, but not all, of the fat has been removed
- **Milk**—The fresh secretion from the udder of a cow (or goat) neither added to nor taken from
- **"Non-dairy" products**—Products manufactured and sold as substitutes for "real dairy" products
- **Pasteurized milk**—Milk that has been heat treated to kill any harmful bacteria present in raw milk
- **Raw milk**—Milk produced by cows (or goats) at the dairy farm
- **Skim milk**—Milk from which all the fat has been removed

OBJECTIVE 2

List the chemical components of milk.

- The typical chemical composition of commercially sold whole milk is:

Water	88.0%
Fat	3.5%
Protein	3.2%
Lactose (milk sugar)	4.6%
Minerals	.7%
100.0%	

NOTE: Milk also contains many vitamins, but their weight is too small to include as a percent.

- The chemical composition of raw milk produced at the farm can vary widely in fat content (2.5-5.5%); the protein content varies much less (2.8-3.6%) and the lactose and minerals hardly vary at all.

  NOTE: The chemical composition (and yield) of raw milk may be influenced by several factors, for example:

  - breed of cow or goat
  - individual animal within a breed
  - stage of lactation
  - feed
  - age
  - climate
  - frequency of milking

OBJECTIVE 3

Calculate the gross components of commercially sold whole milk.

- The percent total solids in milk is the sum of the non-fluid components: fat, protein, lactose and minerals. In the illustration given in Objective 2, the percent total solids would be calculated as follows:

3.5%	fat
3.2%	protein
4.6%	lactose
.7%	minerals
12.0%	total solids

NOTE: An alternative procedure for calculation of percent total solids is:
100%–88% water = 12.0% total solids

- The percent solids-not-fat in milk is the sum of non-fluid, non-fat components: protein, lactose, and minerals. In the illustration given under Objective 2 above, the percent of solids-not-fat would be calculated as follows:

3.2%	protein
4.6%	lactose
.7%	minerals
8.5%	solids-not-fat

NOTE: an alternative procedure for calculation of percent solids-not-fat is:
12% total solids - 3.5% fat = 8.5% solids-not-fat

- The minimum legal composition of whole milk sold to consumers is not less than 3.25% fat and not less than 8.25% solids-not-fat.

OBJECTIVE 4

Complete statements describing the nutritional value of milk for consumers.

- The protein in milk contains all ten of the essential amino acids which are necessary for proper growth.
- The fat in milk supplies certain fatty acids essential for proper human growth.
- The mineral content of milk is especially rich in calcium and phosphorus which are necessary for development and maintenance of bone and teeth.
- Milk is a superior source of vitamins A and D and also the B-complex vitamins; all are necessary for proper health.
- Milk is an excellent (and economical) source of dietary energy with 1 cup (1/2 pint) of whole milk containing 150 calories, a cup of 2% milk contains 120 calories and a cup of skim milk has 90 calories.

  NOTE: Milk contains some cholesterol and saturated fats, both of which have been identified as being adverse to human health, but only if consumed in excessive amounts.

OBJECTIVE 5

Discuss characteristics of dairy products.
(Assignment Sheet 1)

The major classes of dairy products are:

- **Butter**—A dairy product made from cream; it contains just over 80% milkfat and about 19% water and it may or may not contain added salt.

  NOTE: Margarine is similar to butter except that its 80% fat is from plants such as soybean, cottonseed, corn, or safflower; both have the same calories per pound. Unlike butter, margarine contains no cholesterol.

- **Buttermilk or "cultured buttermilk"**—Commercially made directly from skim milk by using a bacterial fermentation process (in olden days it was the skim milk remaining after the fat had been removed from cream during the churning process).

- **Cheese**—A product made from milk; usually by separating the whey from the curd and treating it by a number of methods.

  NOTE: The most common hard cheese sold is cheddar cheese which must contain at least 30% milkfat, not less than 30% protein, and not more than 40% water. It also contains milk minerals, vitamins and (usually) added salt and coloring.

- **Chocolate milk**—Whole milk plus chocolate flavoring and sweetener; "chocolate drink" is similar except it has very little fat.

- **Condensed (or evaporated) milk**—Skim milk from which about 2/3 of the water has been removed; it may or may not have sugar added (requires no refrigeration prior to opening of the container).

- **Creams**—Milk products with a high proportion of fat:

  - Half-and-half: 11% fat and 11% solids-not-fat - used on cereals, coffee or in homemade ice cream.

  - Whipping cream: 32% fat, no added solids-not-fat - used for toppings.

  - Sour cream: Variable fat content, with or without added flavorings - used in cooking or for making dips.

- **Ice cream**—A frozen milk product containing over 8% milkfat, at least 11% solids-not-fat, and about 15% sweeteners plus flavorings and additives. Vanilla ice cream must contain 10% or more fat. Premium grade ice creams are much higher in fat and are much more expensive.

- **Ice milk**—A frozen milk product containing less fat than ice cream; all other components are similar.

- **Low fat milks**—Milks from which some portion of the fat has been removed, for example, 2% fat milk or 1% fat milk or .5% fat milk. If all the fat has been removed, the product is called skim milk; if extra solids-not-fat have been added, it is called fortified milk.

- **Processed cheese**—A specialty product having more water and less milkfat than cheddar or other hard cheeses; it may contain added solids-not-fat and flavorings such as onion, garlic, pepper, bacon or "smoke."

- **Skim milk powder (or powdered milk)**—Skim milk from which virtually all the water has been removed (requires no refrigeration even after opening the container).
- **Whole milk**—Sometimes called "grade A" or "full fat," typically contains 3.5% fat.
- **Yogurt**—A low fat or skim milk product made by fermentation with specific bacteria; it may have fruit, fruit flavoring, or color added.

OBJECTIVE 6

Distinguish between traditional and new dairy products.

Consumers have changed their consumption of the various classes of dairy products over the years.

- Prior to 1945, whole milk, butter and condensed milk were most popular.
- After 1945, consumers decreased butter and condensed milk consumption but began to eat more ice cream and cheese; whole milk consumption per person decreased, but only slowly, until about 1975.
- Since 1975, many consumers have increasingly shifted from whole milk to low fat milk, from cheddar cheese to "lite" (lower fat) cheeses, and from "regular" ice cream to ice milk or non-dairy frozen desserts.
- Recently, yogurt and frozen yogurt (frogurt) have become increasingly popular.

  NOTE: The present trends in consumption of dairy products will likely continue as people seek to reduce calories and avoid cholesterol and saturated fats. However, the drop in total dairy product consumption probably will not be great because the public knows about the beneficial protein, minerals and vitamins found in milk and its products.

OBJECTIVE 7

Define real and artificial dairy products.
(Assignment Sheet 2)

Consumers shopping for dairy foods may find products in the display cases which resemble traditional or new dairy products but which are in fact artificial or synthetic.

- Real dairy products are those which are made primarily from milk and milk products such as cream and solids-not-fat.
- Artificial dairy-type products are those which are designed and sold as substitutes for real dairy products; they are made primarily from nonmilk ingredients.

  NOTE: Artificial dairy-type products meet manufacturing and composition standards which are legally different from the standards used to produce real dairy products.

EXAMPLES: Real dairy products and their substitutes are shown below:

Real dairy products	Artificial dairy-type products
Half-and-Half	Non-dairy creamer
Whipping cream	Vegetable oil-based toppings
Ice cream and ice milk	Frozen desserts containing vegetable oils and no milkfat
Cheddar cheese and processed cheese	"Filled milk" cheeses containing vegetable oils

OBJECTIVE 8

Define the grades of milk.

Milk produced at the dairy farm may be designated grade A raw or "manufacturing" grade. In some states manufacturing grade milk is referred to as grade B or grade C (cheese milk).

- Grade A raw milk at the farm must be produced in facilities with equipment meeting high standards of sanitation defined by the State Health Department; it is intended for processing into fluid milk products and ice cream.
- Manufacturing grade milk at the farm is produced under less stringent conditions and is intended for use in the manufacture of cheese, butter and milk powder.
- Grade A processed milk is milk which has been pasteurized, homogenized, and packaged in facilities and with equipment approved by the State Department of Health.

OBJECTIVE 9

Arrange in order the steps in processing milk.
(Assignment Sheet 3)

1. **Standardization**—Adjustment of the fat content to the required level for a particular product.
2. **Clarification**—Removal of any foreign matter from the milk.
3. **Pasteurization**—Heat treatment of milk to destroy any harmful bacteria present.
4. **Homogenization**— Mechanical treatment of milk to prevent the fat from rising to the top of the container during storage.
5. **Packaging**—Filling the containers with cold, processed milk.
6. **Dating**—Milk is guaranteed to be drinkable by the consumer seven days beyond the date on the package.
7. **Storage**—Packaged milk is held at 38°-40°F for a short time prior to sales to stores.

   NOTE: Milk is packaged mostly in sterile plastic bottles and paper cartons in 1/2 pint, 1 pint, 1 quart, 1/2 gallon and 1 gallon units. Large units are cheaper per ounce of milk and plastic units are cheaper than paper units of equal volume.

OBJECTIVE 10

Arrange in order the steps in the manufacturing of cheese.
(Assignment Sheet 4)

Cheddar cheese:

1. Standardize, clarify, pasteurize and cool the milk to about 72°F; the milk must not be homogenized.
2. Add a special culture of bacteria (similar to buttermilk) to produce acid and add desirable flavor and aroma.
3. Add a small quantity of the enzyme, rennet, to coagulate the milk into a curd (semisolid mass).
4. Cut the curd into small cubes, stir and cook to separate the curds (solids) and the whey (liquid).
5. Drain the whey from the curds and let them knit together in a mass.
6. Cut the curd mass into small pieces, salt them and place in metal containers; apply pressure overnight to remove excess whey.

7. Wrap and store the cheese in temperature and humidity controlled rooms for aging 30-180 days.

8. Cut and package the finished cheese for distribution.

   NOTE: The organoleptic differences between mild and sharp cheddar are due to the length of the aging time; very sharp cheese is at least 180 days old while mild cheese is about 60 days old.

OBJECTIVE 11

Arrange in order the steps in making ice cream.
(Assignment Sheet 5)

1. Mix quantities of cream, milk, solids-not-fat, and sweeteners to meet the desired composition.

2. Pasteurize, homogenize, and cool the mix to 40°F.

3. Semi-freeze the mix in a continuous freezer unit, filling the containers as the soft-frozen product emerges from the unit.

   NOTE: Colorings and liquid flavorings are added to the mix prior to freezing; fruits and nuts, etc. are added to the soft-frozen mix prior to packaging.

4. Store the packaged product in very cold rooms (-10°F) until distributed.

   NOTE: All commercial ice creams contain some volume of air which is added during the soft-freezing process to improve texture.

OBJECTIVE 12

Arrange in order the steps in buttermaking.

1. Make a cream testing about 32% milkfat by removing a portion of skim milk from whole milk.

2. Pasteurize the cream, cool it, and put into a churn.

3. Agitate the cream until the fat coalesces and separates from the buttermilk.

4. Drain the buttermilk, add cold water, and work the mass of butter (fat) to express excess water.

5. Repeat step 4 two times, drain water, remove butter and chill to harden it.

6. Cut the butter into pound or quarter pound units, wrap and package and store at 40°F.

OBJECTIVE 13

Differentiate between processing plant sanitation regulations and plant safety rules.

Milk and dairy products are processed in costly facilities using highly specialized, mostly stainless steel equipment.

- Milk and processed dairy products must meet stringent sanitation regulations so as to protect individual consumers and the public health from milk-borne diseases. The facilities, equipment, and procedures are prescribed by state and federal laws and are administrated by the State Department of Health.
- Plant safety rules are instituted for the physical protection and health of plant workers; they do not pertain to plant products.

MAJOR DAIRY PRODUCING STATES

The major dairy producing states are Wisconsin, Minnesota, New York, Pennsylvania, California, Texas, Ohio, Michigan, Illinois, Washington

ASSIGNMENT SHEET 1

DAIRY PRODUCTS

NAME ________________________________ SCORE ________

OBJECTIVE 14

Determine cost per 100 calories of selected dairy products.

INTRODUCTION

As you have seen in this unit, the number and variety of dairy products is great indeed. Apart from personal tastes, consumers must choose products that give them the best buy for their money.

DIRECTIONS

Your instructor will provide you with examples of several dairy products. Fill out the production evaluation form and determine the cost per 100 calories.

PROCEDURE

1. Students will examine each unit of product for name, nutritional information, usage date, and cost (provided by instructor if not marked).
2. Students will taste each product (as directed by the instructor).
3. Students will fill out the product evaluation form.

PRODUCT EVALUATION FORM

	Type of Product	Cost per Container	Size of Container	Serving Size	Servings per Container	Calories per Serving	Calories per Container *	Cost per 100 Calories**
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								

* Calculate the total calories per container by multiplying the number of servings per container by the number of calories per serving.

** Divide the cost of the container by the total calories and then multiply by 100 to get the cost per 100 calories.

ASSIGNMENT SHEET 2

DAIRY PRODUCTS

V

NAME ______________________________ SCORE ________

OBJECTIVE 15

Compare labels of real and artificial dairy products.

INTRODUCTION

Instructor and students will briefly review the information presented in objective 7 and go as a group to one or more stores selling real and artificial dairy products.

DIRECTIONS

1. Students will first observe the array of real and artificial dairy products available for purchase, paying particular attention to location and space allotted to each.
2. Students will then examine the products, read the labels, and identify the real and the artificial products.
3. Students will first record the names of the real and artificial dairy products and their unit size and cost on the product evaluation form and record the information they found which identified each product as real or artificial.

PRODUCT EVALUATION FORM

	Name of Product	Size of Unit	Cost of Unit	Type of Product *	Ingredients **
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

* Note as ART (artificial) or REAL

** Student will record the information on the label which identified each product as being artificial or real

229

NAME ______________________________ SCORE _______

OBJECTIVE 16 **Identify off-flavors in processed milk.**

DIRECTIONS

1. Students will smell and taste each milk sample as directed by the instructor; instructor will then identify and describe each off-flavor.
2. Students will fill out the product evaluation form.
3. Students will retaste "unmarked" samples to identify the off-flavor in each.

PRODUCT EVALUATION FORM

	Sample Number	Flavor Defect *	Unknown Sample	Flavor Defect **	Flavor Defect ***
1.			A		
2.			B		
3.			C		
4.			D		
5.			E		
6.			F		
7.			G		
8.			H		

* Defect will be identified and discussed by the instructor.

** Defect will be identified by the student.

*** Defect will be identified by the instructor.

ASSIGNMENT SHEET 4 | **DAIRY PRODUCTS** | **V**

NAME ______________________ SCORE ________

OBJECTIVE 17 **Evaluate selected cheeses.**

DIRECTIONS

1. Students will examine each unit of product for name, nutritional information and cost (provided by instructor if not marked).
2. Instructor and students will evaluate the taste, aroma, and texture of the cheeses.
3. Students will be permitted to retaste the samples in order to rank the cheeses from the most to the least desirable using the product evaluation form.

NOTE: At the conclusion of this session, the instructor should provide a sample of butter and margarine to illustrate organoleptic and cost differences.

PRODUCT EVALUATION FORM

	Name of Cheese	Cheese "Score" *	Cost per Package	Size of Package	Serving Size	Servings per Package	Calories per Serving	Calories per Package	Cost per 100 Calories ***
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									

* Student will score the samples as:
a. like very much
b. like
c. neutral (neither like nor dislike)
d. dislike
e. dislike very much

** Caculate the total calories per container by multiplying the number of servings per container by the number of calories per serving.

*** Divide the cost of the container by the total calories and then multiply by 100 to get the cost per 100 calories.

DAIRY PRODUCTS

NAME ______________________________ SCORE ________

OBJECTIVE 18 **Evaluate selected ice creams and ice milks.**

DIRECTIONS

1. Students will examine each unit of product for name, nutritional information and cost (provided by instructor if not marked).
2. Instructor and students will discuss the taste, aroma, and texture of the products.
3. Students will be permitted to retaste the samples in order to rank the products from the most to the least desirable using the product evaluation.
4. Instructor and students will make and compare the homemade products to the prior commercial samples as to appearance, flavor, texture and cost.

PRODUCT EVALUATION FORM

	Name of Product	Type of Product *	Cost per Container	Size of Container	Servings per Container	Cost per Serving **	Calories per Serving	Product Score ***
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								

* Note as IC (ice cream), IM (ice milk), SH (sherbet), or YO (yogurt or frogurt).

** Calculate cost per serving by dividing cost per container by servings per container.

*** Student will score the samples as:

a. like very much
b. like
c. neutral (neither like nor dislike)
d. dislike
e. dislike very much

ASSIGNMENT ANSWERS — DAIRY PRODUCTS — V

ASSIGNMENT SHEET 1	Make sure student has completed chart and arrived at the correct cost of 100 calories for each product.
ASSIGNMENT SHEET 2	Make sure that each student completes the product evaluation form and correctly identifies the products as artificial or real.
ASSIGNMENT SHEET 3	Ensure that students have participated in this activity by completing product evaluation form.
ASSIGNMENT SHEET 4	Make sure that student scored each cheese using the preference scale provided.
ASSIGNMENT SHEET 5	Make sure that each student completes product evaluation form.

NAME ______________________ SCORE ______

OBJECTIVE 1

Match terms associated with the elementary study of dairy products to their correct definitions. Write the correct letters in the blanks.

____ 1. Milk that has been heat treated to kill any harmful bacteria present in raw milk

____ 2. Milk produced by cows (or goats) at the dairy farm

____ 3. The fresh lacteal secretion from the udder of a cow or goat neither added to nor taken from

____ 4. A milk product with a concentrated (high) level of milkfat

____ 5. Milk from which all the fat has been removed

____ 6. Pasteurized milk that has been mechanically treated to keep the milkfat dispersed throughout the milk

____ 7. Products manufactured and sold as substitutes for "real dairy" products

____ 8. Milk from which some, but not all, of the fat has been removed

____ 9. Milk sugar

a. Milk
b. Skim milk
c. Homogenized milk
d. "Non-dairy" products
e. Raw milk
f. Cream
g. Condensed milk
h. Yogurt
i. Low fat milk
j. Pasteurized milk
k. Butterfat
l. Solids-not-fat
m. Lactose

OBJECTIVE 2

List the chemical components of milk.

Constituent	Percent
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

OBJECTIVE 3

Calculate the gross components of commercially sold whole milk.

1. A sample of milk contained 3.9% fat, 3.1% protein, 4.7% lactose, .7% minerals and 87.6% water. Calculate the % total solids______ .

2. A sample of milk contained 3.3% fat, 3.0% protein, 4.5% lactose, .7% minerals and 88.5% water. Calculate the % solids-not-fat______ .

OBJECTIVE 4

Complete statements describing the nutritional value of milk for consumers.

Fill in the blanks in the following statements:

1. The protein in milk contains ____________________ which are necessary for proper growth.
2. The mineral content of milk is especially rich in _________ and ____________________ which are necessary for development and maintenance of bone and teeth.
3. A cup of whole milk contains about ____________________ calories while a cup of 2% fat milk contains about calories.

OBJECTIVE 5

Discuss characteristics of dairy products.

Butter—______________________________

____

____

Buttermilk—______________________________

____

____

Cheese—______________________________

____

____

Chocolate milk—______________________________

____

____

Condensed milk—______________________________

____

____

Creams—______________________________

____

____

Ice cream—______________________________

____

____

Ice milk—______________________________

____

____

Low fat milk— ____

____

____

Processed cheese— ____

____

____

Skim milk powder— ____

____

____

Whole milk— ____

____

____

Yogurt— ____

____

____

OBJECTIVE 6

Distinguish between traditional and new dairy products. Write an "X" in the proper column to denote each product as either *traditional* or *new* (increased usage since 1975).

Product	**Traditional**	**New**
Butter		
Yogurt		
Condensed milk		
Low fat milk		
Regular ice cream		
Ice milk		
Lite cheese		
Cheddar cheese		

OBJECTIVE 7 **Define real and artificial dairy products.**

____

____

____

OBJECTIVE 8 **Define the grades of milk.**

Grade A raw milk at the farm— ______________________________

____

____

Manufacturing grade milk— ______________________________

____

____

Grade A processed milk— ______________________________

____

____

OBJECTIVE 9 **Arrange in order the steps in processing milk.** Write a "1" before the first step, a "2" before the second step and so on.

___ Pasteurization—Heat treatment of milk to destroy any harmful bacteria present.

___ Packaging—Filling the containers with cold, processed milk.

___ Dating—Milk is guaranteed to be drinkable by the consumer seven days beyond the date on the package.

___ Homogenization—Mechanical treatment of milk to prevent the fat from rising to the top of the container during storage.

___ Clarification—Removal of any foreign matter from the milk.

___ Storage—Packaged milk is held at 38°-40°F for a short time prior to sales to stores.

___ Standardization—Adjustment of the fat content to the required level for a particular product.

OBJECTIVE 10

Arrange in order the steps in the manufacturing of cheese. Write a "1" before the first step, a "2" before the second step and so on.

____Add a special culture of bacteria (similar to buttermilk) to produce acid and add desirable flavor and aroma.

____Cut the curd into small cubes, stir and cook to separate the curds (solids) and the whey (liquid).

____Add a small quantity of the enzyme, rennet, to coagulate the milk into a curd (semisolid mass).

____Wrap and store the cheese in temperature and humidity controlled rooms for aging 30-180 days.

____Cut the curd mass into small pieces, salt them and place in metal containers; apply pressure overnight to remove excess whey.

____Cut and package the finished cheese for distribution.

____Drain the whey from the curds and let them knit together in a mass.

____Standardize, clarify, pasteurize and cool the milk to about 72°F; the milk must not be homogenized.

OBJECTIVE 11

Arrange in order the steps in making ice cream. Write a "1" before the first step, a "2" before the second step and so on.

____Semi-freeze the mix in a continuous freezer unit, filling the containers as the soft-frozen product emerges from the unit.

____Store the packaged product in very cold rooms (-10°F) until distributed.

____Pasteurize, homogenize, and cool the mix to 40°F.

____Mix quantities of cream, milk, solids-not-fat, and sweeteners to meet the desired composition.

OBJECTIVE 12

Arrange in order the steps in buttermaking. Write a "1" before the first step, a "2" before the second step and so on.

___ Repeat step 4 two times, drain water, remove butter and chill to harden it.

___ Cut the butter into pound or quarter units, wrap and package and store at 40°F.

___ Pasteurize the cream, cool it, and put into a churn.

___ Agitate the cream until the fat coalesces and separates from the buttermilk.

___ Make a cream testing about 32% milkfat by removing a portion of skim milk from whole milk.

___ Drain the buttermilk, add cold water, and work the mass of butter (fat) to express excess water.

OBJECTIVE 13

Differentiate between processing plant sanitation regulations and plant safety rules.

NOTICE The following assignment sheets are not part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 14 **Determine cost per 100 calories of selected dairy products.** SCORE ________

OBJECTIVE 15 **Compare labels of real and artificial dairy products.** SCORE ________

OBJECTIVE 16 **Identify off-flavors in processed milk.** SCORE ________

OBJECTIVE 17 **Evaluate selected cheeses.** SCORE ________

OBJECTIVE 18 **Evaluate selected ice creams and ice milks.** SCORE ________

WRITTEN TEST ANSWERS

DAIRY PRODUCTS

V

OBJECTIVE 1

1. j
2. e
3. a
4. f
5. b
6. c
7. f
8. i
9. m

OBJECTIVE 2

Constituent	Percent
Water	88.0
Fat	3.5
Protein	3.2
Lactose	4.6
Minerals	.7

OBJECTIVE 3

1. 12.4%
2. 8.2%
3. 3.25% fat and 8.25% solids-not-fat

OBJECTIVE 4

1. essential amino acids
2. calcium; phosphorus
3. 150 (whole milk); 120 (2% milk)

OBJECTIVE 5

- Butter—A dairy product made from cream; it contains just over 80% milkfat and about 19% water and it may or may not contain added salt.
- Buttermilk or "cultured buttermilk"—Commercially made directly from skim milk by using a bacterial fermentation process (in olden days it was the skim milk remaining after the fat had been removed from cream during the churning process).

- Cheese—A product made from milk; usually by separating the whey from the curd and treating it by a number of methods.

- Chocolate milk—Whole milk plus chocolate flavoring and sweetener; "chocolate drink" is similar except it has very little fat.

- Condensed (or evaporated) milk—Skim milk from which about 2/3 of the water has been removed; it may or may not have sugar added (requires no refrigeration prior to opening of the container).

- Creams—Milk products with a high proportion of fat:
  - Half-and-half: 11% fat and 11% solids-not-fat - used on cereals, coffee or in homemade ice cream.
  - Whipping cream: 32% fat, no added solids-not-fat - used for toppings.
  - Sour cream: Variable fat content, with or without added flavorings - used in cooking or for making dips.

- Ice cream—A frozen milk product containing over 8% milkfat, at least 11% solids-not-fat, and about 15% sweeteners plus flavorings and additives. Vanilla ice cream must contain 10% or more fat. Premium grade ice creams are much higher in fat and are much more expensive.

- Ice milk—A frozen milk product containing less fat than ice cream; all other components are similar.

- Low fat milks—Milks from which some portion of the fat has been removed, for example, 2% fat milk or 1% fat milk or .5% fat milk. If all the fat has been removed, the product is called skim milk; if extra solids-not-fat have been added, it is called fortified milk.

- Processed cheese—A specialty product having more water and less milkfat than cheddar or other hard cheeses; it may contain added solids-not-fat and flavorings such as onion, garlic, pepper, bacon or "smoke."

- Skim milk powder (or powdered milk)—Skim milk from which virtually all the water has been removed (requires no refrigeration even after opening the container).

- Whole milk—Sometimes called "grade A" or "full fat," typically contains 3.5% fat.

- Yogurt—A low fat or skim milk product made by fermentation with specific bacteria; it may have fruit, fruit flavoring, or color added.

OBJECTIVE 6

- Butter—Traditional
- Yogurt—New
- Condensed milk—Traditional
- Low fat milk—New
- Regular ice cream—Traditional
- Ice milk—New
- Lite cheese—New
- Cheddar cheese—Traditional

OBJECTIVE 7

Answer must say that real dairy products must be made primarily from milk and milk products and that artificial dairy-type products are made primarily from non-milk products.

OBJECTIVE 8

- Grade A raw milk must be produced in facilities and with equipment meeting State Health Department standards of sanitation (or words to that effect).
- Manufacturing grade milk is produced under conditions less than those required by law for grade A raw milk (or words to that effect).
- Grade A processed milk is milk which has been pasteurized, homogenized, and packaged according to State Health Department standards (or words to that effect).

OBJECTIVE 9 7, 5, 1, 4, 2, 3, 6

OBJECTIVE 10 8, 1, 3, 2, 7, 5, 4, 6

OBJECTIVE 11 4, 3, 1, 2

OBJECTIVE 12 5, 3, 4, 6, 1, 2

OBJECTIVE 13

- Milk and processed dairy products must meet stringent sanitation regulations so as to protect individual consumers and the public health from milk-borne diseases. The facilities, equipment, and procedures are prescribed by state and federal laws and are administered by the State Department of Health.
- Plant safety rules are instituted for the physical protection and health of plant workers; they do not pertain to plant products.

OBJECTIVE 14 Refer to answers to Assignment Sheet 1.

OBJECTIVE 15 Refer to answers to Assignment Sheet 2.

OBJECTIVE 16 Refer to answers to Assignment Sheet 3.

OBJECTIVE 17 Refer to answers to Assignment Sheet 4.

OBJECTIVE 18 Refer to answers to Assignment Sheet 5.

OBJECTIVE SHEET

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

INTRODUCTION

Fish and fish products constitute an important part of our diets and ecosystem. Knowledge of fish and fish products is essential in order not only to eat a balanced diet, but also to understand how varied and widespread a role the harvest and processing of fish plays in our economic system.

UNIT OBJECTIVE

After completing this unit, the student should be able to recognize and appreciate the importance of fish and fish products. The student will demonstrate these competencies by completing assignment sheets, a job sheet, and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with fish and fish products to their correct definitions.
2. State conditions that affect the quality of fish and fish products.
3. Classify important food fish as freshwater or saltwater fish.
4. Select from a list factors that may affect the quality of fish products.
5. Match common fish product forms to their correct descriptions.
6. Select from a list true statements about fish processing techniques.
7. Complete statements about methods for preserving fish products.
8. Select from lists major ports and processing areas and the types of fish found there.
9. Select from a list true statements about regulations and inspection guidelines for fish and fish products.
10. Discuss how fish products are graded.
11. List uses for fish by-products.
12. Calculate cost per serving. (Assignment Sheet 1)

13. Identify fish products available in your area. (Assignment Sheet 2)
14. Evaluate fish freshness and quality. (Assignment Sheet 3)
15. Demonstrate the ability to process fish into steaks and fillets. (Job Sheet 1)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.

  NOTE: Students must complete Activity Sheet 1 before they can complete Assignment Sheet 2, *Identify fish products available in your area.*

- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.
- Contact a local or area university and invite an expert on aquaculture to speak about the importance of fish and fish products in area economies.
- Plan a field trip to an area fish farm.
- Plan a field trip to a local fish market. Have the students bring Assignment Sheet 3 along in order to relate written criteria to sensory experience.

DELIVERY

Objectives 1 and 2

- Complete Activity Sheet 1.
- Demonstrate shrimp's tendency to increase in alkalinity (pH rises) and to turn darker if it is thawed and left for a period of time. Fresh shrimp have a pH of about 7.2; even in ice this pH increases. Beyond 7.7, the shrimp becomes increasingly inedible. This example can be recalled to reinforce Objectives 6, 7, and 14.

  NOTE: Shrimp darken due to natural enzymatic processes; to prevent this some producers provide liquid nitrogen to quick-freeze the catch. Litmus paper is available in drugstores or from your chemistry department.

Objectives 3 through 5

- Take a field trip to a local fish market or local aquaculture establishment.

  NOTE: Have students complete Activity Sheet 1 before the field trip. Have them bring along Assignment Sheet 3.

- Ask students to take special note of fish product forms at the grocery. Remember to reiterate that they should *Evaluate Fish Freshness and Quality* (Assignment Sheet 3) for practice while they are in the fresh fish area.

Objectives 6 and 7

- Reiterate the results of the shrimp pH demonstration or demonstrate it here instead.
- Demonstrate the rate of spoilage with 2 fillets, one heavily salted (rubbed in), the other untreated.

Objectives 8 through 10

- Research *Congressional Quarterly* for the status of regulation, inspection and grading standards that were proposed before the 1989 second session closed. Update students.
- Buy several cans of fancy red or pink salmon. These cans should range in price from the most expensive salmon available to the least expensive can labeled "fancy." Compare quality in class (salmon on saltines). Compare quality without revealing cost. Discuss Assignment Sheet 3, *Evaluate Fish Freshness and Quality* with regard to canned goods.

Objective 11

- Buy some fish flour. Make a batch of cookies from it, and another from regular flour. Serve them to your students and discuss the comparison. Bring up the difference in protein content. Fish Protein Concentrate (F.P.C.) has from 85-92% high-quality protein.

APPLICATION

Objective 12

- Use Assignment Sheet 1 to give students practice in calculating cost per serving.

Objective 13

- Use Assignment Sheet 2 to give students practice in identifying fish products available in your area.

- Review Activity Sheet 1.

Objective 14

- Use Assignment Sheet 3 to give students practice in evaluating fish freshness and quality.

- Take students on a field trip to a local grocery with a fresh fish section. Have students bring along Assignment Sheet 3 or take good notes.

- Have students look at steaks and fillets.

Objective 15

- Use Job Sheet 1 to teach students how to process fish into steaks and fillets.

EVALUATION

Practical Test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.

- Describe the rating scale used on the practical test.

- Give practical test.

- Reteach and retest as necessary.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

- Billmeyer, Patricia. *The Encyclopedia of Wild Game and Fish Cleaning and Cooking*, Yesnaby, Inc., Danville, Pennsylvania P.O. Box 213 Rd 8, 17821 (717-437-3488).
- Carruthers, Richard T. *Understanding Fish Preservation and Processing*, Crough, Margaret, ed. (Technical Paper: No.44) 1987, Vols Tech Asst., 1815 N. Lynn St., Suite 200, Arlington, Virginia 22209 (703-276-1800).
- *Freshwater Fish Farming: How to Begin* (Better Farming Ser.: No. 27) UNIPUB, 4611-F Assembly Dr., Lanham, Maryland, 20706-4391

UNIT REFERENCES

- "Aquaculture: Farming the Waters," American Association for Vocational Instructional Materials, videotape, 1989.
- *Book of Knowledge*, volumes 1-20, Grolier, Inc., New York, 1964.
- Brody, Julius, *Fish By Products Technology*, Avi Publishing Company, Westport, Connecticut., 1965.
- *Fish Farming Techniques*, Larry Belusz, the Instructional Materials Laboratory, University of Missouri-Columbia, the Curators of the University of Missouri, 1987.

- *Freshwater Fish Pond Culture and Management*, Marilyn Chakroff, VITA, United States Government Printing Office, Washington, D.C., 1976.
- Potter, Norman N., *Food Science*, 4th edition, Van Nostrand Reinhold Publishers, New York, 1986.
- *Processing Aquatic Food Products*, Fredrick Warner Wheaton and Thomas B. Lawson, editors, John Wiley and Sons, New York, 1985.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed. and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE	Science 466	Identifies	Definitions	
OBJECTIVE 2	Language Arts 134	Comprehends	Information-written	Cause/effect relationships
OBJECTIVE 3	Science 037	Applies/Uses	Classification schemes	
	Science 283	Describes/ Explains	Human/ animal	
	Language Arts 037	Applies/Uses	Classification schemes	
OBJECTIVE 4	Science 466	Identifies	Definitions	
	Science 365	Describes	Organisms	
	Science 460	Identifies	Cycles	
OBJECTIVE 5	Science 467	Identifies	Definitions	Operational
OBJECTIVE 6	Language Arts 191	Evaluates	Information-oral/written	Validity
	Language Arts 031	Applies/Uses	Definitions	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 7	Science 073	Describes/ Explains	Biochemistry	
	Language Arts 031	Applies/Uses	Definitions	
	Science 114	Describes/ Explain	Chemical reactions	
OBJECTIVE 8	Language Arts 191	Evaluates	Information-oral/written	Validity
OBJECTIVE 9	Language Arts 191	Evaluates	Information-oral/written	Validity
OBJECTIVE 10	Language Arts 092	Composes/ Edits	Reports/ essays	Information-supplying
OBJECTIVE 11	Language Arts 013	Applies/ Uses	Definitions	
	Science 466	Identifies	Definitions	
OBJECTIVE 12	Mathematics 037	Computes	Division	Complex numbers
	Mathematics 083	Computes	Subtraction	Complex numbers
	Mathematics 064	Computes	Multiplication	Complex numbers
	Mathematics 127	Converts	Word problems	Mathematical expressions
OBJECTIVE 13	Language Arts 038	Collects/ Organizes	Information-oral/written	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 14	Science 047	Applies/Uses	Scientific methods	Observation-direct/ indirect
	Language Arts 180	Evaluates	Information-written	
OBJECTIVE 15	Language Arts 035	Attends	Directions/ task	
	Language Arts 013	Applies/Uses	Definitions	
	Science 475	Identifies	Matter	Structure

INFORMATION SHEET

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

OBJECTIVE 1

Match terms associated with fish and fish products to their correct definitions.

- **Algae**—A rootless flowering aquatic plant, the presence of which can affect fish quality

- **Aquaculture**—"Farming" fish, oysters, and other aquatic species; this seafood is produced under varying amounts of human control and intervention

- **Antioxidant**—Chemical that prevents oxygen from reacting with other substances

  NOTE: Most of the time when fish are dipped and frozen (glazing), the water in which they are dipped has an antioxidant added because most bacteria cannot cause spoilage without oxygen present; much glazing is done on the cut surfaces to prevent decay.

- **By-product**—Secondary or incidental product

- **Canning**—Method of preserving fish to a shelf-life of at least several years by sterilizing with heat in sealed containers

- **Crustacean (krus-TAY-shun)**—Category of seafood including crabs, lobsters, shrimp, and freshwater crayfish

- **Demersal (duh-MER-sull)**—Bottom-dwelling fish such as cod, haddock, halibut, flounder, shrimp, oysters, lobsters and clams

  NOTE: These fish are generally far lower in fat than middle- or surface-dwelling fish.

- **Finny fish**—Category of seafood including cod, haddock, herring, salmon, and tuna as well as freshwater bass, crappie, trout, etc.

  NOTE: Not all fish have scales. Catfish are not considered finny fish because they have skin.

- **Genus**—Category of plant and animal classification ranked next below the family and next above the species

- **Heavy metals**—Potentially poisonous elements found naturally, and as a result of industrial dumping in the oceans

  NOTE: The United States Food and Drug Administration (U.S.F.D.A) has regulated the upper limits of cadmium, lead, and mercury (since 1984). In 1971, the F.D.A banned commercial swordfishing as a response to perceived excessive mercury content.

- **Hybrid**—A crossbred product, or the product of genetic engineering

  EXAMPLES: The Oklahoma striped bass, or the Coho salmon are good examples.

- **Menhaden (Men-HAY-den)**—Scrap fish

  NOTE: About 50% of the U.S. catch is menhaden. Menhaden, a relative of herring and anchovy is processed into Fish Protein Concentrate (fish flour - see Activity Sheet 1), animal foods, fertilizer, and common oil.

- **Microbial**—Relates to the action of microscopic living things that generally cause spoilage

- **Monoculture**—Fish are separated by sex, or crossbred to yield offspring that are all male, and raised in single-gender ponds

- **Pelagic (puh-LADGE-ik)**—Middle- or surface-dwelling fish such as anchovies, herring, salmon, and tuna

  NOTE: Because pelagic fish are generally much oilier than demersal fish, they are more often canned than are demersal fish. Vegetable oil is often added beyond their own natural relatively high fat content.

- **Polyculture**—When two or more types of fish are farmed in the same pond

- **Shellfish**—Category of seafood including clams and oysters

OBJECTIVE 2

State conditions that affect the quality of fish and fish products. (Activity Sheet 1)

- **The general health of the fish when it is caught**—Ideally, fish should be free of metals, parasites and/or disease when they are caught.

- **Storage**— Length of time, temperature and other conditions between the time the fish is caught and processed.

  EXAMPLE: Fish caught two days from port and immediately processed on board, or frozen solid until docking and processed immediately is always "fresher" than fish caught two weeks distance from port, in which case the fish may have been thawed repeatedly, if ever frozen.

- **The length of time between when a fish dies and it is cleaned**—Ideally, fish should be cleaned immediately after the catch.

OBJECTIVE 3

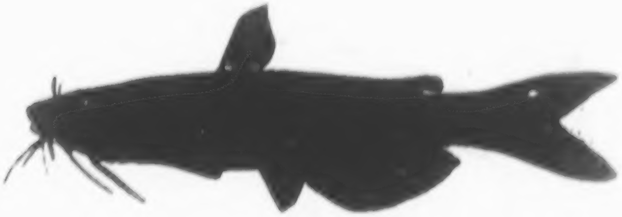
Classify important food fish as freshwater or saltwater fish.

NOTE: All of these fish are finny except for catfish, which have skin. It is important to remember that most freshwater fish have corresponding saltwater "relatives." For example, there are both freshwater, and saltwater trout, salmon, and catfish. Commercially grown fish are harvested from between 3/4 and 1 1/2 pounds.

Freshwater

- **Catfish**

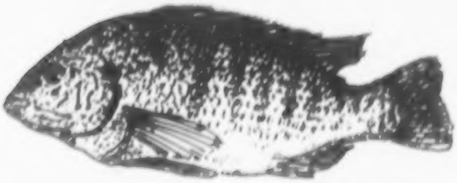
  NOTE: Found in ponds, lakes, and rivers; grown in aquaculture. Species include bullheads, channel cats, and flatheads. Catfish are bottom-feeders, and are grown on fish farms for commercial markets.



- **Tilapia**

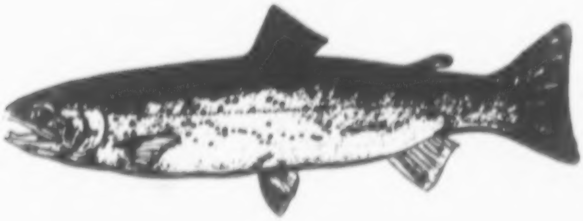
  NOTE: Commonly raised in fish farms, tilapia are hardy, grow rapidly in ponds, taste good, reproduce about once a month, and can withstand wide temperature ranges. Tilapia ponds are selectively harvested; only the big ones are kept. Tilapia are often stocked with a few adult catfish in polycultures, because they reproduce to overpopulation and the catfish control the fry. Catfish are bottom-feeders whereas tilapia are middle- or surface-dwelling fish.

  Some large fish farms control overpopulation by separating fingerlings into single-sex ponds, or monocultures. These farmers may use two different species of tilapia to produce sterile hybrids, or 100% male offspring. These males do not develop sexually, producing more growth.



- **Trout**

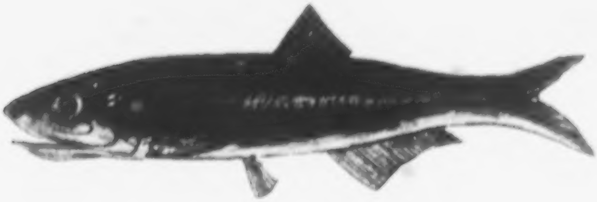
  NOTE:—Trout need very cold, clear water. Species include Lake, Brook, Brown, and Rainbow. Commercial trout are raised on farms, primarily for use in restaurants.



Saltwater

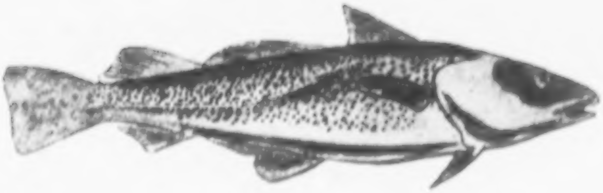
- **Anchovies**

  NOTE: This 2-5 inch pelagial fish is related to herrings and menhaden. Used for flavor rather than for food value, as on pizza.



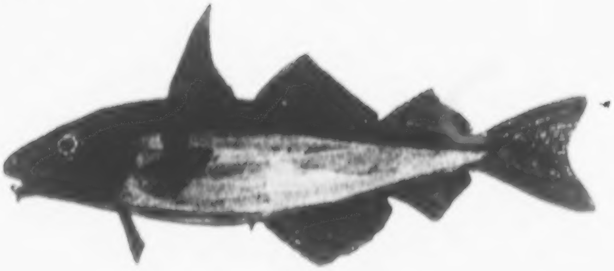
- **Cod**

  NOTE: This demersal fish is a good source of vitamins A and D, found in the liver oil. The Lofoten Islands off Norway are a world-renowned site of cod-liver oil production.



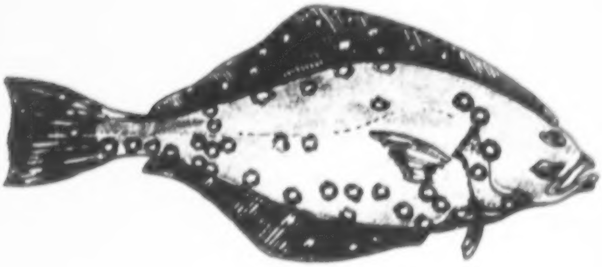
- **Haddock**

  NOTE: This fish is another demersal food fish, a relative of cod.



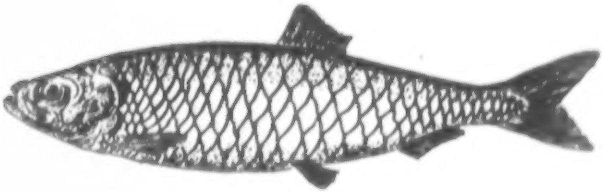
- **Halibut**

  NOTE: This demersal fish is another good source of Vitamins A and D in liver oil (haliver oil). The halibut is a flat-fish, like the flounder.



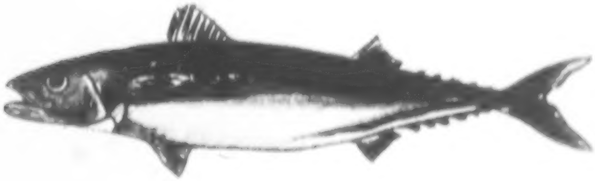
- **Herring**

  NOTE: A pelagial fish, relative to anchovies and the scrap fish menhaden; considered the most important food fish of the Atlantic. Herrings are frequently canned in individual-sized portions.



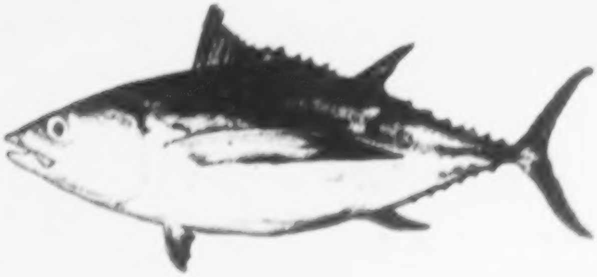
- **Mackerel**

  NOTE: Pelagial fish related to the tuna, mackerel (like Blues, and Jack) are easily recognizable by their metallic blue backs.



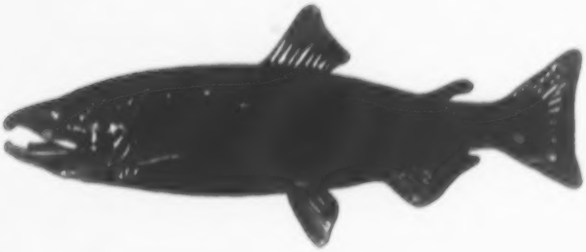
- **Tuna**

  NOTE: Pelagial relative of the mackerel, tuna often grow to about 1600 pounds.



- **Salmon**

  NOTE: Salmon are born in freshwater and live to adulthood in saltwater. They migrate upstream to freshwater to spawn. The Pacific Coast salmon die after spawning, but the Atlantic salmon return to the ocean. Pacific Coast species include chinook, silver or coho, dog or chum, humpback, and sockeye salmon.



OBJECTIVE 4

Select from a list factors that may affect the quality of fish products.

NOTE: More fish are damaged by microbial activity after they die than by inability to resist parasites or disease during their lifetimes. Beneficial or non-harmful bacteria in the intestines and in the surface slime of the fish degrade fish flesh after the fish dies. Furthermore, since bacteria normally live in cold water, their actions are not inhibited by standard preprocessing measures to insure freshness (such as icing down the catch, etc.).

Parasites

- **Intestinal tapeworm**—A yellow grub usually between the sizes of a pinhead, and a match-head that lives in the small intestine.

  EXAMPLE: Chinese tapeworm

  NOTE: Most parasites that affect fish are not readily transmitted to humans.

- **Gill parasites**—By attaching to the gills, these parasites affect the amount of oxygen that the fish can intake. As the parasites cover more and more of the gills, the fish suffocates.

Bacterial Diseases

- While most bacterial diseases attack the fish through the skin, bacteria may undermine the fish's defenses by suffocation, kidney failure, and/or brain damage.

Algaes and Plants

- The protozoa *Gymnocardium brevis* have produced massive fish kills in the past. Immense numbers of these microscopic animals make the water turn red; the phenomena is known as "red tide." Because consumption of fish infected with the protozoa *Gymnocardium brevis* causes respiratory irritation, affected fish must be held off the market.

- Blue-green algae can produce "off flavors" in heavily stocked ponds.

- Pond-scum grows on the bottom, floats to the top, and can prevent sunlight from penetrating to the bottom of the pond (the pond stagnates); this type of algae may impede the harvest.

- Aquatic plants like cattails, bulrushes, and waterlilies can impede harvesting, and harbor unwanted pond-dwellers, like water snakes and turtles.

Water Quality

- Water quality is the primary and limiting factor in aquaculture. Oxygen content, temperature, pH, and dissolved gases should be within optimum range for the species growing there. Water must be free of pollutants.

  EXAMPLE: If one acre produces 3,000 pounds of fish per year, each fish needs 690 gallons of water a year per pound.

Length of Time from Catch to Processing

- The sooner the fish is cleaned after being caught, the higher the quality of the product. Some fish are processed at sea.
- Commercial fish are transported live to processing facilities, and held in storage tanks until killed.

Processing Techniques

- Commercially produced fish are harvested by netting; the pond is drained prior to harvest. The fish must be transported live to a facility, iced down for quick use in local markets, or preserved by the farmer after cleaning.

  EXAMPLE: Farmers who do not have established markets, or who use the fish themselves may salt or smoke the fish to preserve it.

OBJECTIVE 5

Match common fish product forms to their correct descriptions.

- **Fish blocks**—Boneless fillets put together in a frame, compressed slightly, and frozen to make a solid fish form with fixed dimensions (13-17 1/2 lbs., length = 18"-21," width = 10"-12," thickness 1"-2 1/2")
- **Fish portions**—Fish blocks cut into various shaped serving pieces, approximately 2.666 oz. each
- **Fish sticks**—Fish blocks cut into individual serving pieces, approximately .8 oz. each

  NOTE: Fish are battered, breaded, packed and refrozen after being processed into portions and sticks.

- **Whole**—Fish is cleaned and gutted, then canned or frozen bones and all (mackerel is often processed whole)

- **Steaks**—Fish is cleaned and gutted, then sawed at 90° to the spine into oblong or round steaks

- **Fillets**—Fish is cleaned and gutted, then sliced away from the spine, and pulled back from the ribs into boneless fillets (see Objective 15)

OBJECTIVE 6

Select from a list true statements about fish processing techniques.

- Fish are more perishable than many other foods. After the catch, they must be kept cold unless they are processed onboard. Sometimes the fish are stored in the cold hold of the vessel. Ideally, fish are caught, cleaned, and hard frozen all within two hours of the catch.

- More commonly, fish are packed between layers of ice, or stored in chilled brine (sea water), partially frozen. Many fish are not gutted until after the ship has docked. Fish are subject to being either partially, or hard frozen. Cleaned whole fish are frozen and sawed perpendicular to the spine into steaks. The cut edges are glazed, or dipped repeatedly in freezing water treated with antioxidants to better preserve it. Fish fillets frozen into blocks may be sawed into portions or sticks suitable for prebattering. If so, these portions or sticks are breaded, deep-fat fried, cooled, packaged, and refrozen. Many shellfish and crustaceans are freeze-dried, especially shrimp.

- Canning is especially appropriate for pelagial fish like tuna or salmon because of their relatively high oil content. Steps include thawing, gutting, cleaning, and sorting fish for size. The next steps are steaming, cooking, separating light and dark meats and compacting that meat into cylindrical can-filling portions. Those fish not processed onboard are transported iced-down to the factory where they are washed, cleaned, and processed, often by hand.

OBJECTIVE 7

Complete statements about methods for preserving fish products.

NOTE: People have been preserving fish since prehistoric times. Generally, however, traditional methods of fish preservation do not suit the tastes of the American public (smoked salmon is a notable exception).

Traditional Methods

- Smoking—A process in which preservative chemicals and heat kill microorganisms and dry the flesh.
- Salting—Fish can be packed directly in salt or in brine. The salt slows the growth of bacteria and other microorganisms by dehydration.

  NOTE: Smoking and salting are often used together.
- Pickling—Fish are preserved in a vinegar solution (acetic acid). The acid changes the pH of the fish, preventing the growth of bacteria

Modern Methods

- Chemical preservatives like sodium nitrate and nitrite are used to preserve fish, as well as salts of sorbic acid.
- Experimental irradiation with cobalt-60 to pasteurize fish flesh is being tried under controlled conditions, notably in Gloucester, Massachusetts.
- Canning is a process whereby the fish are cleaned, cut to size, and preserved by being placed in a sealed container and sterilized by heat.
- Freezing—Freezing is the use of extremely cold (below 32°F) temperatures to control bacterial growth.

OBJECTIVE 8

Select from lists major ports and processing areas and the types of fish found there.

NOTE: In 1986, worldwide fish farming overall approached 12% of the global commercial take. American aquaculture in 1985 produce less than of all edible fish products consumed in 1985, the United States imported 2.8 billion pounds of fish for consumption.

Saltwater fish

- The top fishing ports in the United States are Boston, and Gloucester, both in Massachusetts, then Portland, Minnesota, and Seattle, Washington. California, Oregon, and the Alaskan Inside Passage are also major fishing areas.
- The largest single area for oyster aquaculture is in the Chesapeake Bay.

- The Great Banks off Newfoundland, Nova Scotia, Great Britain, and Norway yield many fish products. The main catch in these areas is cod.

- The ports in New Orleans yield much of the shellfish and crustaceans consumed in the United States.

- Japan, Canada, the European Economic Community, and the Soviet Union (especially caviar in the case of the U.S.S.R) catch and market a substantial amount of seafood.

Freshwater fish

- Channel catfish, and rainbow trout are the major farmed fish in the United States, with crayfish, and salmon production increasing steadily in recent years.

- Mississippi is the major producer of catfish in the United States (200 million pounds in 1986).

- Idaho produces most of the commercially grown trout in the United States.

  NOTE: Area production of commercially grown food fish continues to increase.

  EXAMPLE: In 1986, Missouri grew 4.8 million pounds of food fish.

- The commercial baitfish industry continues to grow. The minnow production industry is worth $100 million in the United States.

  NOTE: Minnows cost about $2.50/lb. wholesale. Chief producers of these baitfish are Arkansas and Minnesota.

- Louisiana and Texas produce about 50 million pounds of crayfish a year. The bootheel area of Missouri produces some commercially managed crayfish; otherwise, crayfish are harvested incidentally.

OBJECTIVE 9

Select from a list true statements about regulation and inspection guidelines for fish and fish products.

NOTE: As of December 1989, no federal or industry-wide regulation was in effect. Legislation was before Congress to enact laws requiring the fishing industry to follow the same type of inspection and processing regulations as the meat and poultry industries.

- Insofar as standards are set by a state or by private interests, the National Marine Fisheries Service of the United States Department of Commerce cooperates with the United States Food and Drug Administration (FDA), the United States Department of Agriculture (USDA), and state agencies to ensure that those standards of fish product identification, processing techniques, and sanitation quality in general are met.

- Legislation would put regulations for meat inspection, parasite and disease control, and sanitation under the control of the USDA.

- Controls vary from state to state until federal legislation is enacted.

- Some states, including Oklahoma, require that every fish processing facility must be periodically inspected by the state health department.

- Major fish processing companies have voluntary fish inspection to ensure the freshness of each catch purchased. Brokers, people who buy from the fishing trawlers and sell to the processors, will not buy fish that are not fresh and wholesome in appearance.

  NOTE: Fish inspectors stand at the dock and test a certain number of fish from each catch. They cook the fish on the dock and taste it to evaluate freshness. If the fish are not fresh, the inspector may reject the entire catch, thousands of pounds of fish.

OBJECTIVE 10 **Discuss how fish products are graded.**

- Presently fish products are graded relatively randomly; while it is true that salmon costs more than tuna, a 7 oz. can of salmon marked "Fancy Red Sockeye" can range in price from three, to eight dollars, or more. While price, brand-name, and where caught may give the consumer some idea as to the quality implied, personal taste is the best guideline.

- Legislation is pending on the matter of grading fish products. Brokers go by appearance and a lack of fishy smell.

- Trout, catfish and other inland aquaculture fish are graded by size.

OBJECTIVE 11 **List uses for fish by-products.**

- Fertilizer and plant food
- Food for cattle, pigs, dogs, and poultry
- Fish glue (book binding)
- Soaps
- Paints
- Varnishes
- Common (non-medical) oil
- Tanning oil
- Fish protein concentrate (fish flour)
- Seasonings and flavorings

RECENT GROWTH IN THE AQUACULTURE AND BAITFISH INDUSTRIES

Aquaculture has been practiced all over the world for centuries. In Asia (where 75% of all aquaculture today takes place), the practice of farming carp has been traced to 1300 B.C. (China). Elsewhere, fish farming was used to produce food in ancient Rome, Greece, Egypt, and Europe of the Middle Ages.

Scientists project that by the year 2000, world production in aquaculture will yield 40 billion pounds yearly. Within 30 years, aquaculture will represent 25% of total world fish production.

In 1985, the United States paid $9 billion for imported food fish (see Objective 8). Relatively, in 1988, U.S. fish farms produced 400,000 tons of food fish, up 800% from 1978.

Given the great discrepancy in domestic supply and demand, and considering that one surface acre of water will produce 3,000-4,000 marketable fish (with supplemental food) yearly, recent growth in aquaculture bodes well for the farmer/investor.

CAREERS IN FISH AND FISH PRODUCTS INDUSTRIES

Aquaculture operations

Aquaculture economics

Artificial insemination

Biotechnology

Wetlands research

Conservation

Veterinary medicine

Fish hatchery worker

Fish chow research

Fish chow production

Transportation

Fish processing

- scaling
- cutting
- packing
- cooking

Fish sales

Related equipment sales

- cages
- aerators
- feeders
- tanks
- nets

Fish stocking

Bait fish operations

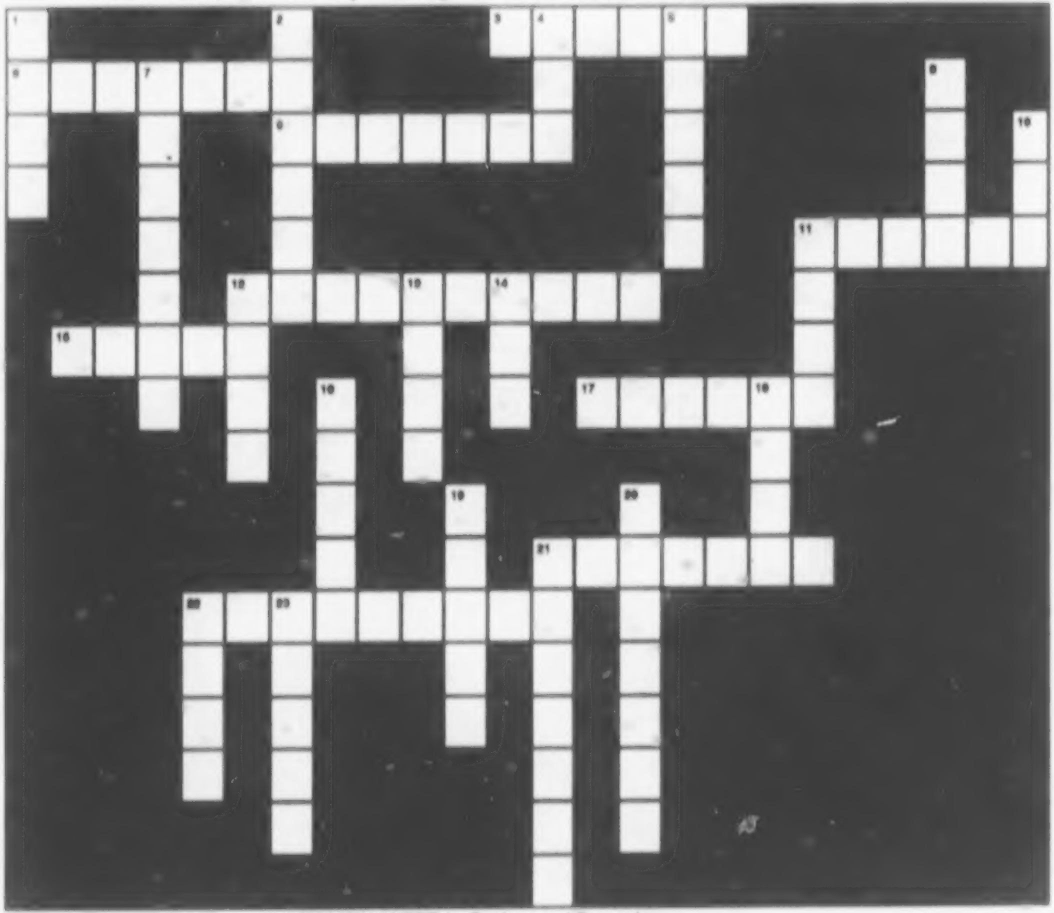
FISH AND FISH PRODUCTS CROSSWORD

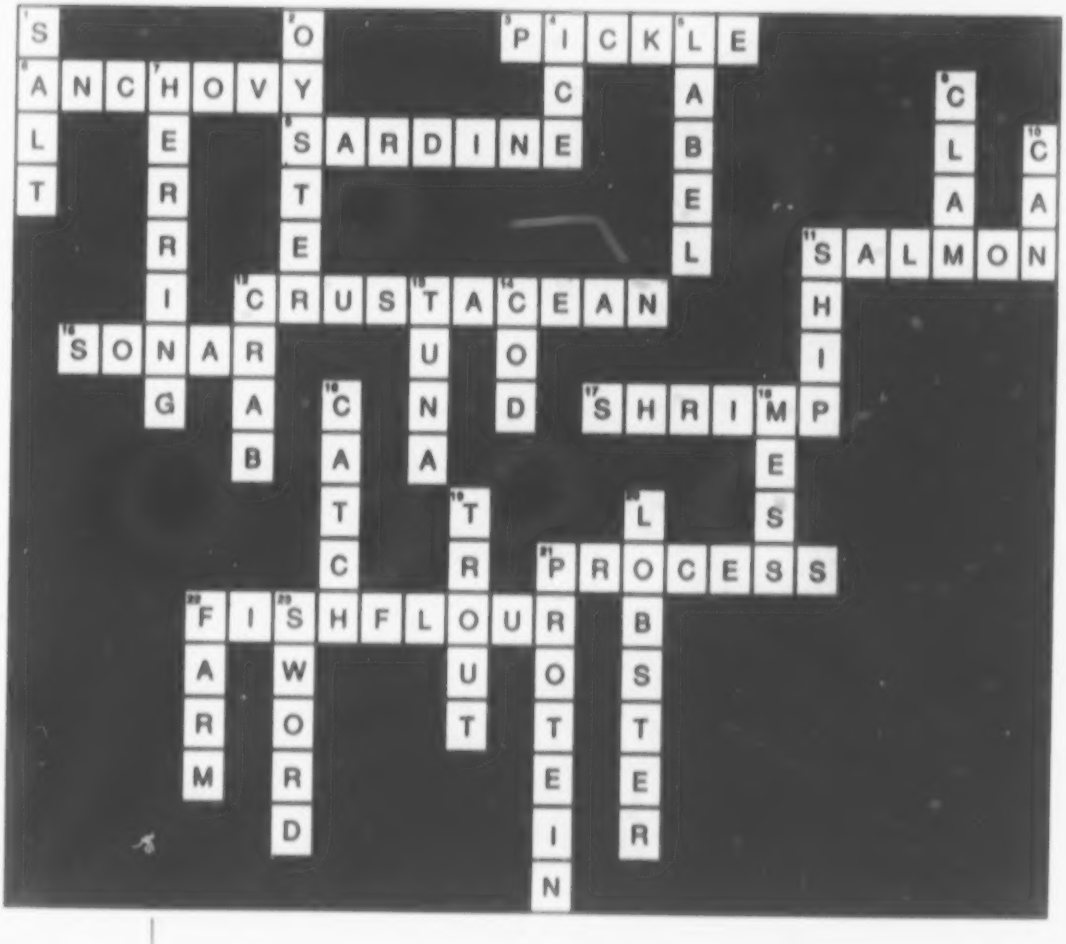
ACROSS

3. Method of preserving fish, or a preserved cucumber
6. Small pelagic fish generally salted heavily; used on pizza
9. Small pelagic fish generally canned in individual portions
11. Large migratory pelagic fish that comes canned, smoked, in steaks, etc.
12. Category of seafood in which crabs, lobsters, and shrimp belong
16. Method of locating schools of fish by sound
17. A crustacean
21. To make fish ready for consumption
22. Fish Protein Concentrate

DOWN

1. Fish are sometimes preserved chemically with a ____________ of sorbic acid
2. A shellfish some eat raw
4. Frozen water; a method of preserving fish
5. Nutritional and ingredient information in canned goods is on the ____________
7. Small pelagic fish generally canned in individual portions
8. A shellfish
10. To enclose in metal hermetically; a method of preserving fish
11. Seagoing vessel
12. A crustacean
13. Large pelagic fish most often preserved by canning
14. Large demersal fish
16. To glean fish from the sea is to _____ them
18. A school of fish, the catch is called a ____
19. Freshwater finny fish farmed in this state
20. A crustacean
21. Fish ____________ concentrate
22. Trout, catfish, oysters; aquaculture
23. In 1971, the FDA temporarily banned the catching of marlin, or ______________ fish in a mercury alert




1 SALT
2 OYSTER
3 PICKLE
4 ICE
5 LABEL
6 ANCHOVY
7 HERRING
8 SARDINE
9 CLAM
10 CAN
11 SALMON
SHIP
12 CRUSTACEAN
CRAB
13 TUNA
14 COD
15 SONAR
16 CATCH
17 SHRIMP
18 MESS
19 TROUT
20 LOBSTER
21 PROCESS
PROTEIN
22 FISHFLOUR
FARM
23 SWORD

ASSIGNMENT SHEET 1

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

NAME ______________________ SCORE ________

OBJECTIVE 12

Calculate cost per serving.

INTRODUCTION

Knowing how to calculate cost per serving is an important factor in maintaining a budget; you want to receive the most for your money.

To calculate cost per serving, divide the price by the weight, to get the price per ounce, or per pound. Then, divide the weight by the number of servings (actual, or suggested as on the label) to get the weight of one serving. Finally, multiply the weight of one serving by the price per ounce or pound (the first weight you calculated).

EXAMPLES: John is having a fish fry at the ranch. Using trout from a local trout farm, he figures that 6 oz. will feed one ranch hand. He paid $3.20 a pound for the fish. What's the cost per serving?

1 lb = 16 oz
$3.20 — 16 = $ .20 per oz.
6 oz. x $.20 = $1.20 per serving

DIRECTIONS

Calculate how much fish cost per serving in the problems below. Show your work and write the answers in the blanks.

1. Sal served a dinner with smoked sliced salmon as an entree. This salmon costs $16.76/lb. Four ounces serves one. Calculate the cost of the salmon for this two-person dinner.

   ____

2. Sal also made shrimp cocktails for two. She used 3/4 lb. of fresh medium shrimp at $4.99/lb. How much did Sal spend on shrimp?______________

3. Dan invited 10 guests to dinner. He planned to serve about 3/4 lb. of shrimp per person in fondue appetizers. Shrimp costs $4.99/lb. How much will Dan spend on shrimp? ______________

4. Dan also bought 20 fillets of trout. Each fillet weighted 3/4 lb. Sea trout costs $1.79/lb. If each guest has 2 (3/4 lb.) fillets, how much did Dan spend on trout?______________

5. Alice bought a box of fishsticks which normally costs $2.99/lb. on sale for $1.79/lb. The box contains 6.7 servings. How much did Alice save per serving?

ASSIGNMENT SHEET 2

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

NAME ______________________ SCORE ________

OBJECTIVE 13 **Identify fish products available in your area.**

INTRODUCTION Whether on the shelves or in the net, it might be nice to know what you're eating.

DIRECTIONS Use the information sheet and Activity Sheet 1 for clues, and answer the following fish-identify questions from the list. Write the correct letters in the blanks.

A. Salmon
B. Cod
C. Halibut
D. Catfish
E. Tilapia
F. Haddock
G. Anchovy
H. Menhaden
I. Trout
J. Herring

____ 1. This fish is ground into animal foods, fertilizer, and Fish Protein Concentrate, the latter of which could balance protein-deficient diets worldwide at the cost of a penny a day per person.

____ 2. Pizza fish

____ 3. A relative of both menhaden and anchovies, this pelagial fish is generally served canned in individual portions.

____ 4. What demersal fish yields haliver oil?

____ 5. Another demersal fish and source of the vitamins A and D in liver oil; the Lofoten Islands off Norway are a famous site for the processing of this fish's oil.

____ 6. This migratory fish comes in both fresh, and saltwater varieties; it is processed into costly steaks, smoked, or canned.

____ 7. This fish has both fresh, and saltwater varieties and some freshwater subspecies are Lake, Brook, Brown, and Rainbow.

____ 8. This fish has skin, not scales, and is found in both fresh and saltwater.

____ 9. Commonly farmed freshwater fish that is sometimes separated by gender into one-sex ponds. This fish is a mouth-brooding African Cichlid.

____ 10. Demersal fish, member of the cod family.

ASSIGNMENT SHEET 3

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

NAME ______________________________ SCORE ________

OBJECTIVE 14

Evaluate fish freshness and quality.

INTRODUCTION

The ability to rate fish for freshness and quality can help you get the most wholesome product for your money. Furthermore, the selection of fresh quality fish and fish products will add to the enjoyment of your meals.

DIRECTIONS

Use the information on this sheet to rate the fish on the following page.

Fish quality refers mainly to its evident freshness. Fish are high in unsaturated fats, which are healthful, but break down quickly. Fish quickly begin to smell fishy if they are getting old. Fish flesh also breaks down faster than does other meat. Beef is aged, but fish must be preserved or consumed before the delicate flesh erodes.

The less a fish has been handled is directly related to the quality of the final product. Human contact breaks down the fish's protective slime layer, and bacteria can set to work, spoiling the meat. Thus, look for firm flesh with a healthy thin layer of slime, and a slightly moist, evenly, and creamy colored appearance.

Using these tips, rate the following fish for freshness and quality.

Use the rating scale below and write the correct letters in the blank.

A. Best fish for freshness and quality

B. Next-best fish for freshness and quality

C. Third-best fish for freshness and quality

D. Barely to non-acceptable fish

E. Non-acceptable fish product

____ 1. Fish One has a ripe fish odor, firm, slimy, creamy colored flesh.

____ 2. Fish Two lacks any smell, and exhibits firm, dry flesh.

____ 3. Fish Three lacks any smell, has firm, moist, and creamy colored flesh, with a slight slimy sheen to the exterior.

____ 4. Fish Four has a ripe fishy smell, sunken and dry flesh which is mottled with patches of green.

____ 5. Fish Five has a moderate fishy odor, firm flesh, a slight sheen, and is slightly off-color.

ASSIGNMENT SHEET 1

1. Four ounces is 1/4 lb. Sal needs 8 ounces total. Divide the price per pound ($16.76) by the amount of fish needed (1/2 lb.).

   $16.76 (price per pound)
   x .50 (1/2 lb. expressed as a percentage)

   ANSWER $ 8.38 for 2 (4 oz.) servings

2. $4.99 (price per pound)
   x .75 (3/4 lb. expressed as a percentage)

   ANSWER 3.7425 or ($3.74 for 3/4 lb. of shrimp)

   Check your answer.
   $4.99 (price per pound)
   -$3.74 (price for 3/4 lb.)
   $1.25 (price per 1/4 lb.)

   $1.25 price per 1/4 lb.
   x 4 quarters in a pound
   $5.00

3. Calculate the price of 3/4 lb. shrimp as above ($3.74). Multiply that price times 10 guests, and you get $37.40.

   3.74 don't forget Dan

   ANSWER $41.14 spent on shrimp

4. 3/4 x 2/1 = 6/4 or 1 2/4 or 1 1/2 lbs trout per guest

   10 guests + Dan = 11 people
   each eating 1 1/2 lbs. trout.
   11 x 1/5 = 16.5 lbs. trout needed.
   1.79 (price per pound)
   16.5 (pounds needed)
   $1.79 price per pound
   16.5 pounds needed
   895
   1074
   179
   29.535 or

   ANSWER $29.54 spent on trout

5. \$2.99 — \$1.79 = \$1.20 amount saved
\$1.20 — 6.7 (numbers of servings) = \$.18

ANSWER \$.18 per serving saved

ASSIGNMENT SHEET 2

1. H
2. G
3. J
4. C
5. B
6. A
7. I
8. D
9. E
10. F

ASSIGNMENT SHEET 3

1. D
2. B
3. A
4. F
5. C

OBJECTIVE 15 **Process fish into steaks and fillets.**

TOOLS AND MATERIALS

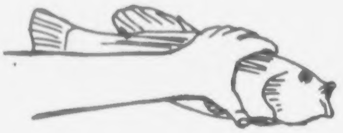
- Cutting board
- (2) Whole fish per student
- 1 medium, 1 large sharp unserrated knife
- Plate
- Water to clean fish, hands
- Waste receptacle
- Broom
- Dust pan
- Soap
- Towel

Optional

- Plastic wrap
- Butcher paper
- Tape
- Storage unit

PROCEDURE

1. Squeeze fish with left hand (if right-handed) just behind the head and gills, palm down. Chop or saw off the fish's head, behind the gills.



2. Grasp fish firmly by the tail (some people wear nubby-palmed gloves), scrape knife from the tail area to the headless area, against the natural lay of the scales, descaling fish. Do both sides carefully.

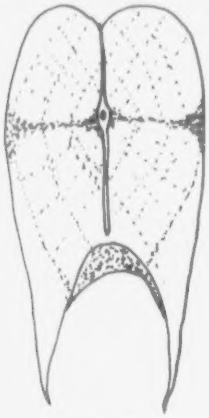
3. Cut off tail if desired.

4. Cut up from the anus to the headless area, removing the entrails without severing them.

5. Rinse body and cavity well.

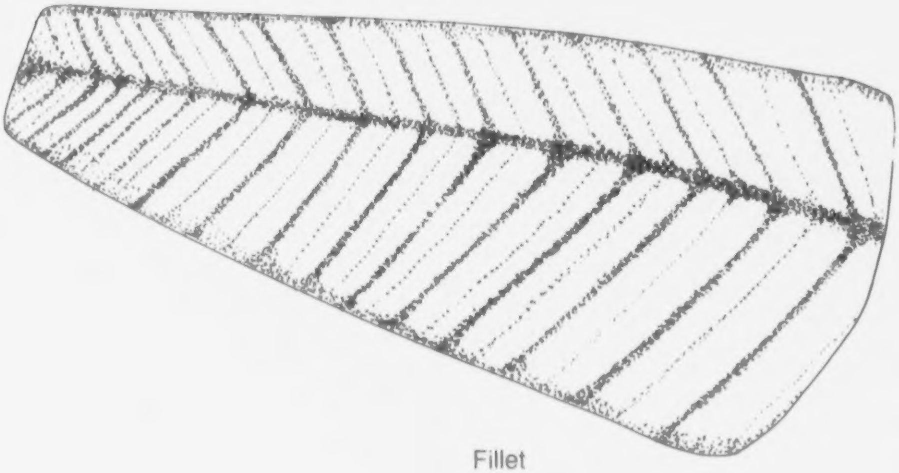
   NOTE: If the fish had been nonfinny, like a catfish, kill fish, gut, clean, decapitate, and use pliers to peel back skin to the tail. Remove tail and skin flap.

6. Steak cut—cut cleaned fish perpendicular to the spine.



Steak Cut

7. Fillets—to fillet a fish, carefully slice along either side of the spine, peeling back the flesh off the ribcage. Be careful not to waste, especially near the headless area.



Fillet

8. Have instructor check your work.
9. Put away tools.
10. Clean up work area.

PRACTICAL TEST 1

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

JOB SHEET 1

Process fish into steaks and fillets.

Student's name ______________________________ Date ___________

Evaluator's name ____________________________ **Attempt no.** _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	Yes	No
1. Removed head.	_____	_____
2. Grasped fish by the tail firmly and descaled fish with the knife.	_____	_____
3. Cut off the tail.	_____	_____
4. Cut up from the anus to the headless area, removing entrails without severing them.	_____	_____
5. Rinsed body and cavity well.	_____	_____
If the fish is a catfish, did the student use the pliers to pull back skin to the tail, and remove both skin flap and tail.	_____	_____
6. Cut the cleaned fish perpendicular to the spine into steak cuts.	_____	_____
7. Carefully sliced along either side of the spine, peeling back the flesh off the ribcage, being careful not to waste, especially near the headless area.	_____	_____
8. Used proper tools correctly.	_____	_____
9. Performed steps in a timely manner.	_____	_____
10. Practiced safety rules throughout procedure.	_____	_____

The student:	Yes	No
11. Provided satisfactory responses to questions asked.	____	____
12. Put away tools and cleaned work area.	____	____

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Processed into steak	4	3	2	1
Processed into fillets	4	3	2	1

EVALUATOR'S COMMENTS

____

____

____

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

NAME ______________________________ SCORE ______

OBJECTIVE 1

Match terms associated with fish and fish products to their correct definitions. Write the correct letter in the blanks. (Question is continued on the following page.)

____ 1. Secondary or incidental product

____ 2. Scrap fish

____ 3. Method of preserving fish to a shelf-life of several years by sterilizing with heat in a sealed container

____ 4. Category of seafood including clams and oysters

____ 5. Potentially poisonous elements found naturally and as a result of industrial dumping in the oceans

____ 6. A crossbred product, or the product of genetic engineering

____ 7. Middle- or surface-dwelling fish like anchovies, herring, salmon, and tuna

____ 8. "Farming" fish, oysters, and other aquatic species; this seafood is produced under varying amounts of human control and intervention

____ 9. Chemical that prevents oxygen from reacting with other substances

____ 10. Category of seafood including crabs, lobsters, shrimp, and freshwater crayfish

____ 11. Bottom-dwelling fish like cod, haddock, halibut, flounder, shrimp, oysters, lobsters and clams

a. Hybrid
b. Demersal
c. Flat-bottom
d. Heavy metals
e. Crustaceans
f. Menhaden
g. Microbial
h. Pollution
i. Pelagic
j. Genetic engineering
k. Antioxidant
l. Canning
m. Microorganism
n. Shellfish
o. Hydroculture
p. Finny fish
q. By-product
r. Aquaculture
s. Bivalves
t. Fronds
u. Algae

___12. Relates to the action of microscopic living things that generally causes spoilage

___13. Category of seafood including salmon, and tuna as well as freshwater bass, crappie, trout, etc., but not catfish

___14. Two or more types of fish are farmed in the same pond

___15. Category of plant and animal classification ranked next below the family and next above the species

___16. A rootless flowering aquatic plant the presence of which can affect fish quality

___17. Fish are separated by sex, or crossbred to yield offspring that are all male, and raised in single-gender ponds

v. Polyculture

w. Order

x. Monoculture

y. Genus

OBJECTIVE 2

State conditions that affect the quality of fish and fish products.

OBJECTIVE 3 **Classify important food fish as freshwater or saltwater fish.** Write an "X" in the correct column.

Fish	Freshwater	Saltwater
Salmon		
Haddock		
Codfish		
Catfish		
Herring		
Anchovy		
Trout		
Tuna		
Tilapia		
Halibut		
Mackerel		

OBJECTIVE 4 **Select from a list factors that may affect the quality of fish products.** Circle the correct answer.

1. Gill parasites affect fish quality by ______________________ .
   a. covering the gills and suffocating the fish
   b. drawing out the fish's body fluids through the gills
   c. causing the gills to decay
2. A yellow grub between the sizes of a pin-head, and a match-head is a ______________________________ .
   a. *Gymnocardium brevis*
   b. Intestinal tapeworm
   c. Montezuma's revenge

3. Most bacterial diseases attack the fish through __________

   a. the eyeball

   b. the nostrils

   c. the skin

4. The protozoa responsible for "red tide" is __________ .

   a. *Gymnocardium brevis*

   b. Chinese tapeworm

   c. Montezuma's revenge

5. A type of algae that can produce "off-flavors" in heavily stocked ponds is___________ .

   a. kelp

   b. blue-green

   c. *Gymnocardium brevis*

6. _________ algae prevents sunlight from penetrating to the pond's bottom, and may impede the harvest.

   a. Blue-green

   b. Pond scum

   c. Seaweed

7. Aquatic plants like ___________ can impede harvesting, and harbor unwanted pond-dwellers, like water snakes and turtles.

   a. Blue-green algae, pond scum, and seaweed

   b. Kelp, *Gymnocardium brevis*, and watercress

   c. Cattails, waterlilies, and bulrushes

8. The primary and limiting factor in aquaculture is __________ .

   a. the availability of stock-fish

   b. water quality

   c. unwanted pond-dwellers

9. The sooner the fish is _______ after being caught, the higher the quality of the subsequent product.

   a. killed

   b. cleaned

   c. skinned

10. Fish are transported________to processing facilities.

   a. live

   b. smoked or salted

   c. dried

11. Commercially produced fish are harvested by_______.

   a. spearing and tanking

   b. hood and line retrieval

   c. netting and pond draining

12. Good water quality has all the following factors in optimum ranges for the species living in the water EXCEPT________.

   a. dissolved gases

   b. oxygen

   c. pH

   d. mineral particles

   e. temperature

OBJECTIVE 5

Match common fish product forms to their correct descriptions. Write the correct letters in the blanks.

____1. Fish is cleaned and gutted, then sawed at 90° to the spine into oblong or round steak

____2. Fish is cleaned and gutted, then sliced away from the spine, and pulled back from the ribs into boneless fillets

____3. Fish is cleaned and gutted, then canned or frozen bones and all

____4. Boneless fillets put together in a frame, compressed slightly, and frozen to make a solid fish form with fixed dimensions

____5. Fish blocks cut into individual serving pieces, approximately .8 oz. each

____6. Fish blocks cut into various shaped serving pieces, approximately 2.666 oz.each

a. Fish sticks

b. Fillets

c. Whole

d. Fish portions

e. Fish blocks

f. Steaks

g. Fish cakes

h. Fish pieces

i. Shaved fish

OBJECTIVE 6

Select from a list true statements abut fish processing techniques. Write an "X" in the blank before each true statement.

____ 1. Canning is especially appropriate for pelagial fish like tuna or salmon because of their relatively high oil content.

____ 2. Factory ships always accompany fishing boats to process the catch at sea.

____ 3. Fish are packed between layers of ice or stored in partially-frozen brine.

____ 4. Fish not processed onboard usually spoil and are considered vast.

____ 5. Many fish are not gutted until after the ship has docked.

____ 6. Many shellfish and crustaceans are freeze-dried, especially shrimp.

OBJECTIVE 7

Complete statements about methods for preserving fish products.

1. ______________________ slows the growth of bacteria by making the fish more acidic.
2. ______________________ is a process in which preservative chemical and heat kill microorganisms and dry the fish.
3. Radiation with ______________________ is an experimental methods for pasteurizing fish flesh.
4. Canning kills microorganisms by sterilizing with ________.
5. Chemical preservatives include ____________ and _____ .
6. Freezing is the use of cold temperatures to control ________________ growth.
7. ________________ slows the growth of bacteria and other microorganisms by dehydration.

OBJECTIVE 8

Select from lists major ports and processing areas and the types of fish found there. Write an "X" in the blank before each correct answer.

1. Largest single area for oyster aquaculture

   ____ a. Hudson Bay

   ____ b. Chesapeake Bay

   ____ c. Gulf of Mexico

   ____ d. Gulf of California

2. Major U.S. producer of catfish

   ____ a. Texas

   ____ b. Arkansas

   ____ c. Mississippi

   ____ d. Missouri

3. Produces most of the commercially-grown trout in the U.S.

   ____ a. Arkansas

   ____ b. Oregon

   ____ c. Idaho

   ____ d. Missouri

4. Three top fishing ports in the U.S.

   ____ a. Boston, Massachusetts

   ____ b. Seattle, Washington

   ____ c. Houston, Texas

   ____ d. Sacramento, California

   ____ e. Alaskan Inside Passage

   ____ f. Miami, Florida

5. Three areas that produce cod

   ____ a. Great Banks off Newfoundland, Nova Scotia

   ____ b. Minnesota

   ____ c. Great Britain

   ____ d. Philippines

   ____ e. Norway

   ____ f. California

6. Three U. S. states that produce crayfish

   ____ a. Idaho

   ____ b. Missouri

   ____ c. Mississippi

   ____ d. Texas

   ____ e. Louisiana

   ____ f. Oklahoma

7. Yields many of the shellfish and crustaceans consumed in the U.S.

____a. New Orleans

____b. Los Angeles

____c. Miami

____d. Seattle

OBJECTIVE 9

Select from a list true statements about regulations and inspection guidelines for fish and fish products. Write an "X" in the blank before each true statement.

____1. Controls vary from port to port until federal legislation is enacted.

____2. All states require that every fish processing facility must be periodically inspected by the state health department.

____3. Major fish processing companies have voluntary fish inspection to ensure the freshness of each catch purchased.

____4. Legislation would put regulations for meat inspection, parasite and disease control, and sanitation under the control of the FDA.

____5. Controls vary from state to state until federal legislation is enacted.

____6. Brokers, people who buy from the fishing trawlers and sell to the processors, will not buy fish that are not fresh and wholesome in appearance.

____7. Legislation would put regulations for meat inspection, parasite and disease control, and sanitation under the control of the USDA.

____8. The National Marine Fisheries Service of the United States Department of Commerce cooperates with the FDA, the USDA, and state agencies to ensure that any standards that exist for fish product identification, processing techniques, quality in general, and sanitation are met.

____9. Glazing is regulated for the coastal states by the USDA, the FDA, and the National Marine Fisheries Service.

OBJECTIVE 10 **Discuss how fish products are graded.**

____

____

____

____

OBJECTIVE 11 **List uses for fish by-products.** Write five uses in the space below.

____

____

____

____

____

____

____

____

____

____

NOTICE The following assignment sheets and job sheet are not a part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 12 **Calculate cost per serving.** SCORE ________

OBJECTIVE 13 **Identify fish products available in your area.** SCORE ________

OBJECTIVE 14 **Evaluate fish freshness and quality.** SCORE ________

OBJECTIVE 15 **Demonstrate the ability to process fish into steaks and fillets.** RATING________

WRITTEN TEST ANSWERS

ELEMENTARY STUDY OF FISH AND FISH PRODUCTS

VI

OBJECTIVE 1

1. q
2. f
3. l
4. n
5. d
6. a
7. i
8. r
9. k
10. e

11 b

12. g
13. p
14. v
15. y
16. u
17. x

OBJECTIVE 2

- General health of the fish when it is caught
- Storage
- Length of time between when the fish dies and when it is processed.

OBJECTIVE 3

Fish	Freshwater	Saltwater
Salmon		x
Haddock		x
Codfish		x
Catfish	x	
Herring		x
Anchovy		x
Trout	x	
Tuna		x
Tilapia	x	
Halibut		x
Mackerel		x

OBJECTIVE 4

1. a
2. b
3. c
4. a
5. b
6. b
7. c
8. b
9. b
10. a
11. c
12. d

OBJECTIVE 5

1. f
2. b
3. c
4. e
5. a
6. d

304

OBJECTIVE 6

1, 3, 5, 6

OBJECTIVE 7

1. Pickling
2. Smoking
3. Cobalt-60
4. heat
5. Sodium nitrite
   Sodium nitrate
6. bacterial
7. Salting

OBJECTIVE 8

1. b
2. c
3. c
4. a, b, e
5. a, c, e
6. b, d, e
7. a

OBJECTIVE 9

3, 5, 6, 7, 8

OBJECTIVE 10

Answer should include these points.

Fish are graded relatively randomly by appearance and lack of a fishy smell, at present but legislation is pending. Trout, catfish, and other inland aquaculture fish are graded by size.

OBJECTIVE 11

Answer should include five of the following:

- Fertilizer and plant food
- Food for cattle, pigs, dogs, and poultry
- Fish glue (book binding)
- Soaps
- Paints
- Varnishes
- Common (non-medical) oil
- Tanning oil
- Fish protein concentrate (fish flour)
- Seasonings and flavorings

OBJECTIVES 12-14

Refer to answers to Assignment Sheets 1 through 3.

OBJECTIVE 15

Refer to Practical Test Rating for Job Sheet 1.

OBJECTIVE SHEET

FRUITS AND VEGETABLES

VII

INTRODUCTION

Fruits and vegetables are a critical category of foods in the human diet. Knowledge of their characteristics and uses can be an enjoyable part of maintaining good health.

UNIT OBJECTIVE

After completing this unit, the student should be able to recognize major types of fruits and vegetables, as well as understand how quality and packaging affect price. The student will demonstrate these competencies by completing the assignment sheets and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with the study of fruits and vegetables to their correct definitions.
2. Select from a list true statements about the nutritional value of fruits and vegetables.
3. Select from a list true statements about how and why fruits and vegetables are sorted.
4. List factors that affect marketability.
5. Match types of processing to their correct definitions.
6. Select from a list true statements about chemical safety and residues in fruit and vegetable processing.
7. Complete statements about the shelf life of fruits and vegetables subjected to different processing methods.
8. Calculate cost per serving. (Assignment Sheet 1)
9. Compare product quality to price and brand name. (Assignment Sheet 2)
10. Inspect fruits and vegetables for quality. (Assignment Sheet 3)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.
- Contact a local university and request information on the cultivation, processing, and/or consumption of fruits and vegetables, and their products.

DELIVERY

Objectives 1 and 2

- Bring in samples of the various types of fruits (drupes, berries, pomes, etc.) and vegetables (earth vegetables, herbage vegetables, etc.), or bring in samples of different cultivars of the same type of fruit or vegetable. Discuss their properties with the students.
- Invite a county extension agent to speak about local or area fruit and vegetable cultivation.
- Use the following facts to stimulate discussion:
  - Apples are the number one global fruit.
  - Oranges are the number one fruit in the western hemisphere.

  - Tomatoes used to be thought of as highly poisonous and were called the "love apple."
  - Plant cells in general are more than two-thirds water.

- Test the pH of the local water. If it is basic, demonstrate how the colors of beets, apples, and potatoes shift if vinegar is added (use a control group with normal water, and one with vinegar added). If your water is not basic, add baking soda and recheck the pH.
  - Apples and potatoes become yellowish if cooked in alkaline water (pH of 8 or higher).
  - Beets look red if cooked in vinegar water and purple or blue if cooked in alkaline water.

Objectives 3 and 4

- Bring in fruits and vegetables of varying size, color, and quality. Show students examples of senescent fruit, fruit with worm spots, vegetables that are not uniform or standard in shape, and broken peas. Open a bag of beans and sort out the bad ones, the rocks, etc, while washing them. Show the class the debris.
- Have an area fruit or vegetable grower, farmer, etc. come in and discuss his or her area of agriculture.

Objective 5

- Bring in cans or frozen samples of purees, nectars, sliced, diced, chopped, etc. fruits and vegetables. Pass them around.
- Read up on labeling trends - see *Consumer Reports* or *Congressional Quarterly* for legislation. Inform your students.

Objective 6

- Have students look up alar in the *Reader's Guide to Periodical Literature*. Discuss the implications of the Alar scare.

Objective 7

- Bring in products with both unexpired and expired dates and compare the products.
- Bring in examples of freezer-burned food.

APPLICATION

Objective 8

- Use Assignment Sheet 1 to give students practice in calculating cost per serving.

Objective 9

- Use Assignment Sheet 2 to show students how to compare product quality to price and brand name.

Objective 10

- Use Assignment Sheet 3 to give students practice in inspecting fruits and vegetables for quality.
- Bring in fruits in various stages of freshness and compare physical characteristics and flavor.

EVALUATION

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Audiovisual Materials

- *Behind the Grade Mark.* 20 min, sound, color film, USDA. Work of USDA inspectors of fruits and vegetables in commercial food processing and canning plants. How products are analyzed, tested and graded to merit the USDA grade marks; what this means to the consumer. Available for rent from Instructional Media Services, Washington State University, Pullman, Washington 99164-5602, phone 509-335-4535, or 509-335-5618. Order by title.

UNIT REFERENCES

- *The Composition of Foods: Fruits and Fruit Juices Raw, Processed, and Prepared*, Agricultural Handbook #8-9, United States Department of Agriculture, Human Nutrition Information Service, by Consumer Nutrition Center, R.L. Rizek, Dir., United States Government Printing Office, Washington, D.C., 20402, revised, August, 1982.
- *The Composition of Foods: Vegetables and Vegetable Products*, Agricultural Handbook #8-11, United States Department of Agriculture, Human Nutrition Information Service, by Nutrition Monitoring Division, R.L. Rizek, Dir., United States Government Printing Office, Washington, D.C., 20402, revised, August, 1984.
- *Food Engineering and Process Applications*, vol. 1, "Transport Phenomena," M. Le Maguer and P. Jelen, editors, Elsevier Applied Science Publishers, London and New York, 1986.
- *Food Processing Technology: Principles and Practice*, P. Fellows, VCH Publishers, Cambridge, Great Britain, 1988.
- *Food Science*, Norman N. Potter, Van Nostrand Reinhold, Publisher, fourth edition, New York, 1986.
- *Food Science and Technology*, Magnus Pyke, fourth edition, John Murry, London, 1981.
- *Nutritional and Safety Aspects of Food Processing*, Steven R. Tannenbaum, ed., Marcel Dekker, Inc., New York, 1979.
- "Oklahoma Agriculture 2000," Division of Agriculture, Oklahoma State University, Stillwater, Oklahoma, December 1982.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Language Arts 013	Applies/uses	Definitions	
	Science 466	Identifies	Definitions	
	Science 470	Identifies	Food groups	
OBJECTIVE 2	Language Arts 139	Comprehends	Information-written	Context
OBJECTIVE 3	Language Arts 139	Comprehends	Information-written	Context
	Science 467	Identifies	Definitions	Operational
	Science 470	Identifies	Food groups	
OBJECTIVE 4	Language Arts 139	Comprehends	Information-written	Context
	Language Arts 131	Comprehends	Information-written	Varied types
OBJECTIVE 5	Language Arts 131	Comprehends	Information-oral	Varied types
OBJECTIVE 6	Language Arts 191	Evaluation	Information-written	Validity

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 6	Language Arts 191	Evaluation	Information-written	Validity
	Language Arts 139	Comprehends	Information-written	Context
OBJECTIVE 7	Language Arts 139	Comprehends	Information-written	Context
OBJECTIVE 8	Free Enterprise 041	Defines	Economic terms	Price
	Mathematics 039	Computes	Division	Decimals
	Mathematics 230	Solves problems	Proportion	
	Mathematics 262	Uses calculators	Division	
	Mathematics 047	Computes	Division	Whole numbers
	Mathematics 127	Converts	Word problems	Mathematical expression
OBJECTIVE 9	Mathematics 229	Solves problems	Generate conclusion	Deductive reasoning
	Language Arts 256	Infers/ predicts	Information-written	Outcomes/ solutions
	Free Enterprise 118	Identifies	Cost factors	
OBJECTIVE 10	Science 045	Applies/uses	Scientific methods	Analysis qualitative/ quanititive
	Science 047	Applies/uses	Scientific methods	Observation
	Science 037	Applies/uses	Classification schemes	
	Mathematics 097	Constructs	Charts/tables/ graphs	

OKLAHOMA FRUIT AND VEGETABLE PRODUCTION

The United States imports large quantities of fruits and vegetables and their preparations. Many of these fruits and vegetables could be grown in Oklahoma. However, Oklahoma has always been a minor producer, especially of vegetables. Agricultural economists project produce to be increasingly important in Oklahoma's economic future.

Apples have traditionally been grown in Adair and Cherokee Counties in Oklahoma.

Strawberries are also grown in Adair and Cherokee Counties. For the last 20 years, Oklahoma has rated about 4th in the nation in pecan production (they are produced in about two-thirds of the state).

For the last 20 years, Oklahoma has ranked about 20th in the nation in peach production.

Peaches are grown primarily in Wagoner, Muskogee, McClain, and Garvin Counties in Oklahoma, and are well-adapted to the Oklahoma climate, especially where extra water is available.

Melons and sweet potatoes benefit from Oklahoma's long growing season.

Blueberries are grown in Oklahoma from Tulsa east to the Arkansas border and from Interstate 40 south to Texas.

Blackberries, nectarines, and plums are grown throughout Oklahoma.

Grapes are grown in Oklahoma, but the cultivars that are grown (American Bunch and French Hybrid) require the establishment of special markets.

OBJECTIVE 1

Match terms associated with the study of fruits and vegetables to their correct definitions.

- **Antioxidant**—Chemicals or treatments that act as oxygen acceptors and prevent fruit browning

  NOTE: Antioxidants react with sugars in fruits. Otherwise, those sugars would react with oxygen and the cut fruit would brown.

- **Berry**—Fruit that is generally small and delicate

  EXAMPLES: Grapes, cranberries

- **Canning**—A method of preserving fruits and vegetables by sterilizing with heat; a shelf life of several years may be attained

  NOTE: The processing order is harvesting, receiving, washing, grading, heat blanching, peeling and coring, can filling, removing air, sealing, sterilizing, cooling, labeling, and packing.

- **Citrus**—Fruit high in citric acid

  EXAMPLES: Oranges, grapefruits, lemons

- **Compression**—The act of pressing, pulping, crushing, or squeezing produce into a mass of fruit or vegetable material

  EXAMPLE: Tomatoes for sauce or picante may be compressed.

- **Impact**—The violent and coarse chopping of produce by using two opposing blades

  EXAMPLE: Cabbage for coleslaw is processed by impact forces.

- **Shearing**—The act of slicing, halving, dicing, or flaking of produce by using one or two interacting or rotating blades, adjustable for various depth cuts

- **Cultivar**—Different varieties of the same fruit or vegetable

NOTE: Cultivars vary in chemical makeup, cell structure, and enzyme activity. Some varieties are better suited for a given processed product than others. Cultivars of the same fruit or vegetable may vary in ability to resist temperature extremes, diseases and pest infestation, yield, time to harvest, storage life, and other textural qualities.

- **Degrees Brix**—Commonly used measure of the sugar concentration in citrus juices

  NOTE: The higher the Degrees Brix, the greater the sugar concentration in the juice. There are seasonal changes not only in the Degrees Brix, but also in the acid content and Brix-to-acid ratio. The higher the Brix-to-acid ratio, the sweeter and less tart the juice.

- **Drupe**—Type of fruit containing a single pit

  EXAMPLES: Apricots, cherries, peaches, plums

- **Enzymes**—Chemical substances produced in the living cells of all plants and animals that act to regulate biological processes without being chemically changed themselves

  EXAMPLE: Catalase and peroxidase are two of the most heat-resistant enzymes. If these two enzymes are killed by scalding, other enzymes that cause food to degrade are also inactivated. This food can now be frozen and off-flavors will be less likely to develop over long storage periods.

- **Fruits and vegetables**—In terms of use, those eaten with the meal's main course are vegetables; those eaten as dessert are commonly known as fruits

  NOTE: While "fruits" generally refers to edible plant ovaries, some vegetables are earth vegetables (potatoes) or herbage vegetables (lettuce). Fruit vegetables are like peas or avocados.

- **Maturity**—When the fruit or vegetable is ready to eat or, if harvested, will become ready to eat upon further ripening (See "Ripe")
- **Melon**—Large fruit with a tough rind
- **Nut**—A fruit with a bony, leathery, or woody covering that doesn't open when the fruit is ripe

- **Pericap**—The fleshy and edible part of a fruit or vegetable that surrounds the seeds

- **Pome**—Type of fruit with many pits

  EXAMPLES: Apples, quince, pears

- **Ripe**—The optimal state when the color, flavor, and texture of a fruit or vegetable are at their peak

- **Senescence**—The condition in which a fruit or vegetable is overripe to the point of inedibility

- **Tropical and Subtropical Fruits**—Types of fruit which require warm climates, but are not citrus fruits

  EXAMPLES: Bananas, dates, figs, pineapples, papayas, and mangos

- **Turgor**—Whether or not the fruit or vegetable is firm in texture, or wilted

  NOTE: Turgor is associated with health and freshness; if the fruit is injured or frozen and thawed, etc., the ability to remain turgid is lost.

OBJECTIVE 2

Select from a list true statements about the nutritional value of fruits and vegetables. (Supplement 2)

- Citrus fruits, as well as leafy green vegetables and tomatoes, are all good sources of Vitamin C.
- String beans and cabbages are good sources of Vitamin C.
- Carrots and yellow vegetables are good sources of Vitamin A.
- Sweet potatoes, spinach, and tomatoes are also rich sources of Vitamin A.
- Nuts are an excellent source of niacin; string beans, peas, white potatoes, and spinach are also good sources.
- Produce in general is a good natural source of fiber, potassium, and vitamin A.

OBJECTIVE 3

Select from a list true statements about how and why fruits and vegetables are sorted.

NOTE: Producers give growers seed of selected cultivars and oversee operations to ensure that a good crop of raw materials is available. Sorting of these pre-planned crops is therefore mainly a matter of eliminating "bad apples."

- The primary reason for sorting fruits and vegetables is to eliminate unsuitable produce before processing.

  EXAMPLE: Cranberries bounce well if not overripe; cranberries pass through a separator and are eliminated from the most demanding uses if they cannot bounce over a barrier.

- Fruits and vegetables are sorted with regard to ripeness, color, texture, and sweetness.

  EXAMPLE: Asparagus spears are tenderly processed whole, but the larger, tougher spears, as well as the end pieces, are processed into soups and dips, where appearance and texture are less noticeable after processing.

- Peas are sorted during washing.

  EXAMPLE: A frothy mixture of water and mineral oil is dense enough to float whole peas, but less-than-perfect peas and debris sink.

- Citrus juices are graded by Degrees Brix-to-acid ratio.

OBJECTIVE 4

List factors that affect marketability.

- **Consumer demand.**

  EXAMPLE: Pumpkins sell well (and are naturally in season) in the late fall; watermelons are generally plentiful and inexpensive around Independence Day. Cranberries are in high demand from mid-November to around the first of the year.

- **Seasonability**—Fruits or vegetables bought "in season" are always lower in price and generally higher in quality than fruits or vegetables that must be imported from other areas where that product is in season.

- **Freshness**—If the fruit is damaged, senescent, or stored improperly, it will wilt and marketability will suffer accordingly.

- **Overall appearance, especially color.**

  EXAMPLE: Few people prefer the translucent and relatively waxy looking, pale red or pink fruits we call "winter tomatoes." Most people prefer deep red, wholesome-looking, ripe, summer tomatoes if given the choice. Likewise, green or brown-spotted bananas sell less rapidly and with less overall consumer satisfaction than do bright yellow and mostly unmottled bananas.

- **Visual appeal of the display**—The way the product is presented in the store.

  EXAMPLE: Lettuce is shipped in boxes of 24 heads, with each head having dark green, relatively coarse and dry leaves around the tender, light green interior heads. These outer leaves are picked off before the product is put on display.

OBJECTIVE 5 **Match types of processing to their correct definitions.**

NOTE: There are three ways to reduce the size of fruits and vegetables for better packaging. These types of forces are compression, impact, and shearing. Some fruits and vegetables are packaged whole, such as canned new potatoes.

- **Whole**—Some fruits and vegetables are peeled but are not reduced in size before processing
- **Juices**—Extracted by compression forces; this popular method consists of extraction, clarification (filtering), taking the air out, pasteurizing (killing enzymes), concentration, essence add-back, then canning or bottling, and freezing if desired
- **Purees**—Extracted or processed with compression and shearing to make products such as apricot nectar, baby foods, or tomato sauce
- **Dried**—Some dried foods are extracted or processed by compression, such as fruit leathers; others by shearing forces, like banana chips, potato chips, and potato flakes

- **Shelling**—Dehulling is accomplished by exposure to infrared radiation (IR) for 15-65 seconds, and holding to cool from 0-20 minutes in a well-insulated container

  NOTE: Infrared radiation has the advantage over conventional low steam pressure heating because steam-blanching causes unacceptable loss in consistency, color, and especially sugar-to-starch ratio. Sugar-to-starch ratio plummets after dehulling, so proper timing in harvest and quick post-dehulling processing are essential.

- **Shredding**—Processed with impact forces, using opposing blades to chop the fruits or vegetables, like shredded coconut, carrots, or coleslaw-style cabbage

- **Slicing**—Method of shearing fruits and vegetables, either in half, dicing into tiny cubes or flaking, as with potato chips; these products can be canned, frozen, or dried as desired

OBJECTIVE 6

Select from a list true statements about chemical safety and residues in fruit and vegetable processing.

- The use of pesticides worldwide is increasing rapidly. Without pesticides, commercial fruit and vegetable production would be impossible.

- The commercial processing steps of washing, peeling, blanching, and sterilization by canning can effectively remove pesticides; sometimes detergents are added to the wash water, as well as the hot water or steam blanching, to reduce insecticide levels to a virtually nonexistent level.

- Home processing is generally slightly less effective than commercial pesticide removal because there are more steps in commercial processing.

- Instruments to detect residues are often capable of reading pesticide levels as dilute as a few parts per billion.

OBJECTIVE 7

Complete statements about the shelf life of fruits and vegetables subjected to different processing methods.

NOTE: In the future, regulations on labeling will require more products to bear an expiration date.

- Canning preserves food to a shelf life of several years.
- Frozen fruits and vegetables that have been pasteurized by blanching can be stored for up to two years without significant loss in either flavor or appearance.
- Fresh fruits and vegetables have a maximum shelf life of two to three weeks if properly attended (Misted periodically, kept cool, rotated to ensure proper air circulation, handled carefully, etc.).
- Dried fruits and vegetables have a shelf life of up to two years if kept in a cool, dark, dry place. If storage is less optimal, preservation quality will suffer accordingly. Most critical to food perishability is rehydration; the food was preserved by removing the water necessary for bacteria to initiate spoilage.

CAREERS IN FRUITS AND VEGETABLES

- Planting and farming
- Picking
- Trucking and transport
- Processing
- Marketing
- Genetics
- Research
- Quality control
- Food technology

NOTE: A good book to read about careers in food technology is *(The Definitive Study of) Your Future in Food Technology Careers*, by Gale R. Ammerman, Richards Rosen Press, Inc., New York, 1975. This book includes a list of available scholarships in the back.

NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS

(Dashes (-) denote lack of reliable data for a constituent believed to be present in measurable amount)

					NUTRIENTS IN INDICATED QUANTITY													
Iten No. (A)	Foods, approximate measure units, and weight	(B)		Water (C)	Food energy (D)	Protein (E)	Fat (F)	Carbohydrate (G)	Calcium (H)	Phosphorus (I)	Iron (J)	Potassium (K)	Vitamin A value (L)	Thiamin (M)	Riboflavin (N)	Niacin (O)	Ascorbic (P)
			Grams	%	Calories	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	Milligrams	Internat'l units	Milligrams	Milligrams	Milligrams	Milligrams
	FRUITS																
	Apples: Raw, unpeeled 3 1/4 in diam. (about 2 per lb with cores).	1 apple	212	84	125	Trace	1	30	15	21	.6	233	190	.06	.04	.2	8
	Apricots: Raw, without pits (about 12 per lb with pits).	3 apricots	107	85	55	1	Trace	14	18	25	.5	301	2,890	.03	.04	.6	11
	Blackberries: Raw	1 cup	144	85	85	2	1	19	46	27	1.3	245	290	0.04	0.06	0.6	30
	Blueberries: Raw	1 cup	145	83	90	1	1	22	22	19	1.5	117	150	.04	.09	.7	20
	Grapes: European type (adherent skin), raw: Thompson Seedless	10 grapes	50	81	35	Trace	Trace	9	6	10	.2	87	50	.03	.02	.2	2
	Oranges: All commercial varieties, raw: Whole, 2 5/8-in diam., without peel and seeds (about 2 1/2 per lb with peel and seeds)	1 orange	131	86	65	1	Trace	16	54	26	.5	263	260	.13	.05	.5	66
	Peaches: Raw Whole, 2 1/2-in diam. peeled, pitted (about 4 per lb with peels and pits).	1 peach	100	89	40	1	Trace	10	9	19	.5	202	1,330	.02	.05	1.0	7
	Plums: Raw without pits Japanese and hybrid (2 1/8-in diam. about 6 1/2 per lb with pits).	1 plum	66	87	30	Trace	Trace	8	8	12	.3	112	160	.02	.02	.3	4
	Strawberries: Raw, whole berries, capped	1 cup	149	90	55	1	1	13	31	31	1.5	244	90	0.04	0.10	0.9	88

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
Watermelon:																
Raw, 4 by 8 in wedge with rind and seeds (1/16 of 32 2/3-lb melon, 10 by 16 in.)	1 wedge	926	93	110	2	1	27	30	43	2.1	426	2,510	.13	.13	.9	30
GRAIN PRODUCTS																
Beans (dry):																
Common varieties as Great Northern, navy and others:																
Cooked, drained:																
Great Northern:	1 cup	180	69	210	14	1	38	90	266	4.9	749	0	.25	.13	1.3	0
Pea (navy):	1 cup	190	69	225	15	1	40	95	281	5.1	790	0	.27	.13	1.3	0
Peas:																
Split, dry, cooked	1 cup	200	70	230	16	1	42	22	178	3.4	592	80	.30	.18	1.8	-
Asparagus (green):																
Cooked, drained:																
Cuts and tips, 1 1/2 to 1-in lengths:																
From raw	1 cup	145	94	30	3	Trace	5	30	73	.09	265	1,310	0.23	0.26	2.0	38
From frozen	1 cup	180	93	40	6	Trace	6	40	115	2.2	396	1,530	.25	.23	1.8	41
Beans:																
Lima, immature seeds, frozen, cooked, drained:																
Thick-seeded types (Fordhooks)	1 cup	170	74	170	10	Trace	32	34	153	2.9	724	390	.12	.09	1.7	29
Thin-seeded types (baby limas)	1 cup	180	69	210	13	Trace	40	63	227	4.7	709	400	.16	.09	2.2	22
Snap (green):																
Cooked, drained:																
From raw (cuts and French style)	1 cup	125	92	30	2	Trace	7	63	46	.8	189	680	.09	.11	.6	15
Beets:																
Cooked, drained, peeled:																
Whole beets, 2-in diam.	2 beets	100	91	30	1	Trace	7	14	23	.5	208	20	.03	.04	.3	6
Diced or sliced	1 cup	170	91	55	2	Trace	12	24	39	.9	354	30	.05	.07	.5	10
Canned, drained solids:																
Whole beets, small	1 cup	160	89	60	2	Trace	14	30	29	1.1	267	30	.02	.05	.2	5
Diced or sliced	1 cup	170	89	65	2	Trace	15	32	31	1.2	284	30	.02	.05	.2	5

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
Broccoli:																
Cooked, drained:																
From raw:																
Stalk, medium size	1 stalk	180	91	45	6	1	8	158	112	1.4	481	4,500	.16	.36	1.4	162
Stalks cut into 1/2-in pieces	1 cup	155	91	40	5	Trace	7	136	96	1.2	414	3,880	.14	.31	1.2	140
From frozen:																
Stalk, 4 1/2 to 5 in long	1 stalk	30	91	10	1	Trace	1	12	17	.2	66	570	.02	.03	.2	22
Chopped	1 cup	185	92	50	5	1	9	100	104	1.3	392	4,810	.11	.22	.9	105
Cabbage:																
Common varieties:																
Raw:																
Coarsely shredded or sliced	1 cup	70	92	15	1	Trace	4	34	20	0.3	163	90	0.04	0.04	0.02	33
Carrots:																
Raw without crowns and tips, scraped:																
Whole, 7 1/2 by 1 1/8 in, or strips, 2 1/2 to 3 in long (18 strips)	1 carrot	72	88	30	1	Trace	7	27	26	.5	246	7,930	.04	.04	.4	6
Cooked (Crosswise cuts), drained	1 cup	155	91	50	1	Trace	11	51	48	.9	344	16,280	.08	.08	.8	9
Corn, sweet:																
Cooked, drained:																
From raw:																
Ear 5 by 1 3/4 in	1 ear	140	74	70	2	1	[illegible]	2	69	.5	151	310	.09	.08	1.1	7
From frozen:																
Ear, 5 in long	1 ear	229	73	120	4	1	27	4	121	1.0	291	440	.18	.10	2.1	9
Kernels	1 cup	165	77	130	5	1	31	5	120	1.3	304	580	.15	.10	2.5	8
Canned:																
Cream style	1 cup	256	76	210	5	2	51	8	143	1.5	248	840	.08	.13	2.6	13
Whole kernel:																
Vaccum pack	1 cup	210	76	175	5	1	43	6	153	1.1	204	740	.06	.13	2.3	11
Lettuce (raw):																
Butterhead, as Boston types:																
Leaves	1 outer or 2 inner or 3 heart	15	95	Trace	Trace	Trace	Trace	5	4	.3	40	150	.01	.01	Trace	1
Peppers:																
Sweet (about 5 per lb. whole) stem and seed removed:																
Raw	1 pod	74	93	15	1	Trace	4	7	16	.5	157	310	.06	.06	.4	96
Cooked, boiled, drained	1 pod	73	95	15	1	Trace	3	7	12	.4	109	310	.05	.05	.4	70

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
Potatoes:																
Cooked:																
Baked (about 2 per lb, raw):																
Peeled after baking	1 potato	156	75	145	4	Trace	33	14	101	1.1	782	Trace	.15	.07	2.7	31
Boiled (about 3 per lb, raw):																
Peeled after boiling	1 potato	137	80	105	3	Trace	23	10	72	.8	556	Trace	.12	.05	2.0	22
Peeled before boiling	1 potato	135	83	90	3	Trace	20	8	57	.7	385	Trace	.12	.05	1.6	22
French-fried (strip, 2 to 3 1/2 in long):																
Prepared from raw	10 strips	50	45	135	2	7	18	8	56	.7	427	Trace	.07	.04	1.6	11
Frozen, oven heated	10 strips	50	53	110	2	4	17	5	43	.9	326	Trace	.07	.01	1.3	11
Spinach:																
Raw, chopped	1 cup	55	91	15	2	Trace	2	51	28	1.7	259	4.460	.06	.11	.3	28
Cooked, drained:																
From raw	1 cup	180	92	40	5	1	6	167	68	4.0	583	14,580	.13	.25	.9	50
From frozen:																
Chopped	1 cup	205	92	45	6	1	8	232	90	4.3	683	16,200	.14	.31	.8	39
Leaf	1 cup	190	92	45	6	1	7	200	84	4.8	688	15,390	.15	.27	1.0	53
Squash (cooked):																
Summer (all varieties), diced, drained	1 cup	210	96	30	2	Trace	7	53	53	.8	296	820	.11	.17	1.7	21
Winter (all varieties), baked, mashed	1 cup	205	81	130	4	1	32	57	98	1.6	945	8,610	.10	.27	1.4	27
Sweetpotatoes:																
Cooked (raw, 5 by 2 in; about 2 1/2 per lb):																
Baked in skin, peeled	1 potato	114	64	160	2	1	37	46	66	1.0	342	9,230	.10	.08	.8	25
Tomatoes:																
Raw, 2 3/5-in diam. (3 per 12 oz pkg.)	1 tomato	135	94	25	1	Trace	6	16	33	.6	300	1,110	.07	.05	.9	28
Canned, solids and liquid	1 cup	241	94	50	2	Trace	10	14	46	1.2	523	2,170	.12	.07	1.7	41

ASSIGNMENT SHEET 1

FRUITS AND VEGETABLES

NAME ______________________________ SCORE _______

OBJECTIVE 8 **Calculate cost per serving.**

INTRODUCTION The ability to calculate cost per serving is essential to getting the most for your food dollar.

DIRECTIONS To calculate cost per serving, divide the price of the product by the number of servings. Calculate the cost per serving in the following problems.

1. Oranges cost $.58/lb. Alice bought four oranges which altogether weighed 1 1/2 lbs. How much did each orange, on the average, cost Alice?_________

2. Delicious apples cost $.78/lb. John got 2 1/2 lbs. How much did John spend on apples._________

3. Delicious apples went on sale from $.78/lb. to $.48/lb. John bought another 2 1/2 lbs. How much did John save this time over last time?_________

4. Kiwi fruit cost $.38 each on sale. K.C. spent $5.32 on kiwi fruit. How many kiwi fruit did K.C. buy?_________

NAME ______________________________ SCORE ______

OBJECTIVE 9 **Compare product quality to price and brand name.**

INTRODUCTION Getting the most for your food dollar is more than a matter of quantity per penny. Sometimes the higher-priced product is the better bargain; other times the least costly item will suffice. Learn how to compare product quality to price and brand name by answering the questions below.

1. Cindy is going to serve a dinner of steak, potatoes, and a vegetable side dish. Although her mom always bought Brand A green beans, Cindy isn't sure whether or not she should spend the extra money. Brand A green beans come packed full with very little water, are of standard size and color, and are tender and firm. The cost is $.80/can. Brand B green beans cost $.50/can, have some tops still attached, and are fair in color, quality, and quantity.

   Brand C, the generic green beans cost $.30/can, are less bright in color, uneven and broken in length, tend to be stringy, and are mostly water. Which brand of green beans should Cindy choose for her colorful side dish?

   ____

2. Don wants to serve his seven-year old brother a casserole (with green beans) for an after-school snack. He is really on a tight budget, yet wants to eat some of the casserole, too. Which brand should he use?

   ____

3. Kim wants to pack a nice picnic lunch to impress her new beau. She can't decide whether to use the small, dull-red, and spotty Brand A delicious apples at $.38/lb., or the large, red, shiny, and spotless Brand B delicious apples at $.78/lb. Which apples should Kim use?

   ____

4. John wants to make apple butter. Which apples should he use?

   ____

ASSIGNMENT SHEET 3

FRUITS AND VEGETABLES

NAME ______________________________ SCORE _______

OBJECTIVE 10 **Inspect fruits and vegetables for quality.**

INTRODUCTION The ability to skillfully inspect fruits and vegetables for quality is essential to getting the most enjoyment for your food dollar.

DIRECTIONS The primary characteristic of quality produce is freshness. Check for proper turgor or firmness and generally an excess of whatever quality the fruit or vegetable is most remembered by - green beans, yellow squash, red tomatoes, - all should be *really* colorful, and without surface blemishes or pest-holes. Check for a nice, ripe odor, and an overall appealing, edible appearance.

EXAMPLES: Bananas should be yellow with brown flecks, not too soft or bruised.

Citrus fruits should be heavy with juice.

The stem-end of cantaloupes should be soft and sunken, but not overly so.

Onions should not have green shoots and should be firm but not dried out.

Potatoes should not have sprouts (eyes), and should be crisp and firm.

Bearing these directions in mind, inspect fruits and vegetables for quality. Fruits and vegetables are ranked into three categories:

1. Number 1—First class shipper

2. Number 2—Overripe or slightly damaged (sell local)

3. Cull—Throw away, or feed to livestock

Your instructor will bring in fruits and vegetables for evaluation. Discuss exterior and cut characteristics. Rank the produce according to their quality, on the grid.

Product	Number 1	Number 2	Cull
1 ____________	______	______	______
2 ____________	______	______	______
3 ____________	______	______	______
4 ____________	______	______	______
5 ____________	______	______	______
6 ____________	______	______	______

ASSIGNMENT SHEET 1

1. .22
2. $1.95
3. .75
4. 14

ASSIGNMENT SHEET 2

1. Brand A
2. Brand B
3. Brand B
4. Brand A

ASSIGNMENT SHEET 3

Ensure that student completed evaluation form.

WRITTEN TEST

FRUITS AND VEGETABLES VII

NAME ______________________________ SCORE ________

OBJECTIVE 1

Match terms associated with the study of fruits and vegetables to their correct definitions. Write the correct letter in the blank.

____ 1. Type of fruit containing a single pit

____ 2. Large fruit with a tough rind

____ 3. The optimal state when the color, flavor, and texture of a fruit or vegetable are at their peak

____ 4. A fruit with a bony, leathery, or woody covering that doesn't open when the fruit is ripe

____ 5. When the fruit or vegetable is ready to eat or if harvested will become ready to eat upon further ripening

____ 6. Chemical substances produced in the living cells of all plants and animals that act to regulate biological processes without being chemically changed themselves

____ 7. The condition in which a fruit or vegetable is overripe to the point of inedibility

____ 8. Type of fruit with many pits

____ 9. Fruit that is generally small and delicate

____ 10. The fleshy and edible part of a fruit or vegetable that surrounds the seeds

____ 11. Fruit high in citric acid

____ 12. Chemicals or treatments that act as oxygen acceptors and prevent fruit browning

a. Shearing
b. Compression
c. Melon
d. Stale
e. Turgor
f. Fleshy
g. Citrus
h. Canning
i. Green
j. Fruits
k. Pome
l. Southern fruits
m. Senescence
n. Proteins
o. Enzymes
p. Degrees Brix
q. Cultivar
r. Impact
s. Snapping
t. Berry

___13. A method of preserving fruits and vegetables by sterilizing with heat; a shelf life of several years may be attained

___14. Different varieties of the same fruit or vegetable

___15. Commonly used measure of the sugar concentration in citrus juices

___16. Produce normally eaten with the meal

___17. Types of fruit which require warm climates but are not citrus fruits

___18. Produce normally eaten as dessert

___19. Whether or not the fruit or vegetable is firm in texture, or wilted

___20. The act of slicing, halving, dicing or flaking of produce by using one or two interacting, or rotating blades, adjustable for various depth cuts

___21. The violent and coarse chopping of produce by using two opposing blades

___22. The act of pressing, pulping, crushing, or squeezing produce into a mass of fruit or vegetable material

u. Maturity

v. Antioxidant

w. Tropical and subtropical fruits

x. Preserving

y. Cultivation

z. Ripe

aa. Pericap

bb. Fructose

cc. Nut

dd. Chopped

ee. Drupe

ff. Vegetables

OBJECTIVE 2

Select from a list true statements about the nutritional value of fruits and vegetables. Write an "X" in the blank before each true statement.

____ 1. Carrots are a good source of Vitamin A.

____ 2. String beans and cabbages are good sources of Vitamin C.

____ 3. Sweet potatoes, spinach, and tomatoes are rich sources of Vitamin A.

____ 4. Grapes are an excellent source of niacin.

____ 5. Nuts, string beans, peas, white potatoes, and spinach are all good sources of niacin.

____ 6. Citrus fruits, as well as leafy green vegetables and tomatoes, are all good sources of Vitamin C.

____ 7. Radishes are a rich source of Vitamin A.

____ 8. A serving of mushrooms is a good daily source of Vitamin C.

____ 9. Produce in general is a good natural source of fiber, potassium, and Vitamin A.

____ 10. Onions are rich in Vitamin A.

OBJECTIVE 3

Select from a list true statements about how and why fruits and vegetables are sorted. Write an "X" in the blank before each true statement.

____ 1. Citrus juices are graded by Degrees Brix-to-acid ratio.

____ 2. Fruits and vegetables are sorted just prior to canning.

____ 3. Beans and cranberries are not sorted.

____ 4. The primary reason for sorting fruits and vegetables is cleanliness.

____ 5. The primary reason for sorting fruits and vegetables is to eliminate unsuitable produce before processing.

____ 6. Peas are sorted during washing.

____ 7. Fruits and vegetables are sorted with regards to ripeness, color, texture, and sweetness.

OBJECTIVE 4 **List factors that affect marketability.**

____

____

____

____

____

OBJECTIVE 5 **Match types of processing to their correct definitions.** Write the correct letter in the blank.

____1. Processed with impact forces, using opposing blades to chop the fruits or vegetables, like coconut, carrots, or coleslaw style cabbage

____2. Extracted by compression forces, this popular method consists of extraction, clarification (filtering), taking the air out, pasteurizing (killing enzymes), concentration, essence add-back, then canning or bottling, and freezing if desired

____3. Method of shearing fruits or vegetables, either in half, dicing into tiny cubes or flaking, as with potato chips; these products can be canned, frozen, or dried, as desired

____4. Extracted or processed with compression and shearing, this type of packaging results in products like apricot nectar, baby foods or tomatoes for sauce

____5. Some fruits and vegetables are peeled but are not reduced in size before processing

____6. Accomplished prior to washing by exposure to infrared (IR) radiation for 15-65 seconds, and cooled in a well-insulated container from 0-20 minutes

a. Purees
b. Dried
c. Juices
d. Whole
e. Chopping
f. Shredding
g. Slicing
h. Cubing
i. Sauces
j. Soups
k. Shelling (dehulling)

____ 7. Some dried foods are extracted or processed by compression, such as fruit leathers; others by shearing forces like banana chips, potato chips and potato flakes

OBJECTIVE 6

Select from a list true statements about chemical safety and residues in fruit and vegetable processing. Write an "X" in the blank before each true statement.

____ 1. About half of worldwide commercial fruit and vegetable production depends on the use of pesticides.

____ 2. Home processing is generally slightly less effective than commercial pesticide removal.

____ 3. Instruments to detect residues are generally not very accurate.

____ 4. The commercial processing steps of washing, peeling, blanching, and sterilization by canning can effectively remove pesticides.

____ 5. The use of pesticides worldwide is increasing rapidly.

____ 6. Sometimes detergents are added to the washwater to reduce insecticide levels.

OBJECTIVE 7

Complete statements about the shelf life of fruits and vegetables subjected to different processing methods. Write the correct answer in the blank.

1. If kept in a cool, dark, dry place, dried fruits and vegetables have a shelf life of up to ____________________.
2. If properly attended, fresh fruits and vegetables have a shelf-life of ________________________.
3. Frozen fruits and vegetables can be stored for up to ________.
4. Canning preserves food to a shelf-life of ________________.

NOTICE The following assignment sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 8 **Calculate cost per serving.** SCORE ________

OBJECTIVE 9 **Compare product quality to price and brand name.** SCORE ________

OBJECTIVE 10 **Inspect fruits and vegetables for quality.** SCORE ________

OBJECTIVE 1

1. ee
2. c
3. z
4. cc
5. u
6. o
7. m
8. k
9. t
10. aa
11. g
12. v
13. h
14. q
15. p
16. ff
17. w
18. j
19. e
20. a
21. r
22. b

OBJECTIVE 2

1, 2, 3, 5, 6, 9

OBJECTIVE 3

1, 5, 6, 7

OBJECTIVE 4

- Consumer demand
- Seasonability
- Freshness
- Overall appearance, especially color
- Visual appeal of the display

OBJECTIVE 5

1. f
2. c
3. g
4. a
5. d
6. k
7. b

OBJECTIVE 6

2, 4, 5, 6

OBJECTIVE 7

1. two years
2. two-three weeks
3. two years
4. several years

OBJECTIVE 8

Refer to answers to Assignment Sheet 1.

OBJECTIVE 9

Refer to answers to Assignment Sheet 2.

OBJECTIVE 10

Refer to answers to Assignment Sheet 3.

OBJECTIVE SHEET

GRAIN PRODUCTS

VIII

INTRODUCTION

Grain products provide the world with most of its food calories and about one half of its protein. Knowledge of what grains are important to U.S. agriculture and how they are grown and processed can give you a deeper understanding of products from your breakfast cereal to world dietary preferences. Grains and grain products are essential to the stability of our nation's health and economy.

UNIT OBJECTIVE

After completing this unit, the student should be able to identify types, parts, and uses of grain; milling, storing and marketing options for grains; and be able to demonstrate basic steps in cleaning and grading grain and processing wheat into flour. The student will demonstrate these competencies by completing the assignment sheets, job sheets, and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with grain products to their correct definitions.
2. Label types of grains.
3. State the function of parts of the grain.
4. Label parts of grain.
5. Distinguish among characteristics of common grains used for human consumption.
6. Match types of wheat flour to their descriptions.
7. Name types of flour according to their uses.
8. Match types of milling processes to their descriptions.
9. Identify grains according to their standard milling processes.
10. Select from a list true statements about the essential nutrients found in grains.
11. List products made from common grains for human consumption.

12. List criteria for high grade wheat.

13. Select from a list true statements about requirements for grain storage.

14. Discuss the use of chemical controls.

15. Complete statements concerning U.S. grain markets.

16. List nonfood uses for grain products.

17. Identify common grains. (Assignment Sheet 1)

18. Identify corn sweeteners used in snack foods. (Assignment Sheet 2)

19. Solve a dockage problem. (Assignment Sheet 3)

20. Demonstrate the ability to

    a. Clean a sample of grain. (Job Sheet 1)

    b. Grade a sample of wheat. (Job Sheet 2)

    c. Process wheat into flour. (Job Sheet 3)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

- Contact your local county extension agent for up-to-date publications concerning grains produced in your area.

- To obtain plant and seed samples contact Dr. Kevin Donnelly, Department of Agronomy, Ag Hal., Oklahoma State University, Stillwater, Oklahoma 74078. A crops judging kit is available which contains:

  - Plant samples
  - Seed samples
  - Grain grading samples
  - Seed analysis samples

  The charge for all four components is $60.00 (unmounted). Each of the components can also be purchased separately. Individual samples of seeds are also available.

- Obtain the following equipment:
  - Scales
  - 3-4 sets of sieves for grading and cleaning grains available from local elevator
  - Globe or map of the world
  - Portable flour grinder
- Ask an agronomist to speak to the class prior to the cleaning and grading assignments/jobs. Ask that insect charts, examples of uncleaned wheat, wheat damaged by insects, disease, and fungus, and wheat that has garlicky smell and/or musty odor be included as visual aids. Ask that the class be shown how other grains occurring in a sample lowers its grade. Ask that a sample include cheat. Also ask that a chart showing what percentage of dockage and foreign material is allowed be included.

DELIVERY

Objectives 1 through 4

- Discuss the cafeteria menu, favorite dishes, snacks, and beverages to determine grains used, terms, and definitions that may be needed for a discussion of these items.

  NOTE: Determine which foods are not connected to grain products. Remember livestock and poultry are fed grain to produce foods for human consumption.

- Handle grain seeds as they are identified.
  - Supply durum and spring wheat seeds. Explain durum is a higher protein wheat suited for making pasta: macaroni, spaghetti and noodles; spring wheat is used for cake flour, cookies and pastries.
  - Supply rice seed. Rub seed from hull with fingers. Grain may be eaten in this form.
  - Supply barley seeds. Seed to be sprouted for beverage flavorings must be free of harmful pesticides.
  - Supply corn seed. If possible, supply dented field corn, rounded, edible sweet corn, and popcorn.
  - Supply rye seed.
- Supply oat seed that you hull, then mash to make a "rolled oat."

- Show students rolled oats are edible, but generally unacceptable to Western eating habits.
- Label parts of grain explaining purpose of endosperm, hull, bran, and germ.

Objectives 5 through 13

- Discuss the types of flour the mill produces from the various grains processed in the mill.
- Discuss the products made from the various grains the mill processes.
- Observe the grain storage facilities located on the mill site.
- Visit a wheat milling operation.
    - Observe:
        1. Methods of receiving grain
        2. Methods of transporting grain to elevators
        3. Methods of grading grain - including determination of moisture content
        4. Different sizes and types of rollers used to crush grain
        5. Actual milling operation to see various stages of the process
        6. Packaging of product
        7. Labeling of product
        8. Shipping of product
        9. Laboratory experiments to determine
            a. New uses of product
            b. Standard product for special customers
    - Ask a dietitian in the laboratory to give nutritional information about products milled.
    - Write a thank-you note to the mill manager or your tour guide.

Objective 14

- Have class discuss pros and cons of chemical controls.

Objective 15

- On a world map, show major countries that receive or buy United States grain. Lecture briefly on major markets.

Objective 16

- Suggest students debate advantages/disadvantages of gasohol as fuel substitute.

APPLICATION

Objective 17

- Use Assignment Sheet 1 to give students practice in identifying common grains.

Objective 18

- Use Assignment Sheet 2 to reinforce the idea that grain products have many uses and are found in many processed foods.

Objective 19

- Have students complete Assignment Sheet 3 in order to understand "real life" situations that confront grain farmers.

- Use with Supplement 5.

Objective 20

- Use Job Sheets 1 through 3 to teach students skills that are used on a larger scale in the grain industry.

EVALUATION

Practical test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.

- Describe the rating scale used on the practical test.

- Give practical test.

- Reteach and retest as necessary.

Written test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Audiovisual Materials

- *The Amazing Art of Flour Milling.* 44-min., sound, color, film, R.J.S. Carter, Co., 1970. Covers the entire art of flour milling from the growing of the grain to the baking and serving of the bread. There are time-lapse pictures of wheat growing underground as well as photographs in extreme slow motion inside the various cleaning and milling machinery. Charts and diagrams aid in explaining each step of the milling process. Important parts of laboratory testing are also shown. Available for rent from Instructional Media Services, Washington State University, Pullman, Washington 99164-5602, phone (509)-335-4535, or (509)-335-5618. Order by title.

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- Potter, Norman N., *Food Science*, 4th ed., Van Nostrand Reinhold, New York, 1986.

- Oklahoma FFA Crops Contest 1990-1992 Official Rules and Regulations.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Language Arts 013	Applies/Uses	Definitions	
	Science 466	Identifies	Definitions	
OBJECTIVE 2	Science 483	Identifies	Organisms	Plants
OBJECTIVE 3	Science 382	Describes	Plants	Parts/ functions
	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 4	Science 382	Describes	Plants	Parts/ functions
OBJECTIVE 5	Science 482	Identifies	Organisms	Plants
	Language Arts 134	Comprehends	Information-written	Comparison/ content
OBJECTIVE 6	Language Arts 013	Applies/Uses	Definitions	
	Science 466	Identifies	Definitions	
	Science 474	Identifies	Matter	Physical properties

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 7	Science 474	Identifies	Matter	Physical Properties
	Science 476	Identifies	Matter	Uses
OBJECTIVE 8	Science 467	Identifies	Definitions	Operational
	Language Arts 013	Applies/Uses	Definitions	
	Science 473	Identifies	Matter	Phases/states
OBJECTIVE 9	Language Arts 147	Comprehends	Information-written	Sequence
	Language Arts 013	Applies/Uses	Definitions	
	Science 473	Identifies	Matter	Phases/states
OBJECTIVE 10	Language Arts 139	Comprehends	Information-written	Context
	Language Arts 191	Evaluates	Information-written	Validity
OBJECTIVE 11	Science 051	Classifies	Matter	
	Language Arts 038	Collects/ Organizes	Information-written	
OBJECTIVE 12	Language Arts 038	Collects/ Organizes	Information-written	
	Science 342	Describes/ Explains	Matter	Properties
	Science 345	Describes/ Explains	Matter	Uses

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 13	Language 139	Comprehends	Information-written	Context
	Language Arts 191	Evaluates	Information-written	Validity
	Science 460	Identifies	Cycles	Biological
OBJECTIVE 14	Language Arts 074	Composes/ Edits	Paragraphs	
	Science 159	Describes/ Explains	Ecology	
OBJECTIVE 15	Free Enterprise 065	Describes/ Explains	Economic concept	
	Free Enterprise 084	Describes/	Foreign trade	
OBJECTIVE 16	Science 345	Describes/ Explains	Matter	Uses
	Language Arts 038	Collects/ Organizes	Information	
OBJECTIVE 17	Language Arts 052	Composes/ Edits	Drafts-written	
	Science 378	Describes/ Explains	Plants	
OBJECTIVE 18	Language Arts 038	Collects/ Organizes	Information-written	
	Science 047	Applies/uses	Scientific method	Observation

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 19	Mathematics 127	Converts	Word problems	Mathematical expressions
	Mathematics 064	Computes	Multiplication	Complex numbers
	Mathematics 083	Computes	Subtraction	Complex numbers
	Free Enterprise 118	Identifies	Cost factors	
OBJECTIVE 20a	Language Arts 035	Attends	Directions/ task	
	Mathematics 185	Measures	Direct	Weight
	Science 493	Measures	Mass/weight	
	Mathematics 193	Measures	Metric	Weight
	Mathematics 075	Calculates/ Evaluates	Percent	In/decrease/ markup/ discount
	Language Arts 042	Collects/ Organizes	Information-written	Notes
	Language Arts 147	Comprehends	Information-written	Sequence
	Science 046	Applies/Uses	Scientific method	Data-gathering
	Science 047	Applies/Uses	Scientific method	Observation
OBJECTIVE 20b	Language Arts 035	Attends	Directions/ task	
	Mathematics 185	Measures	Direct	Weight
	Mathematics 193	Measures	Metric	Weight

	SKILL AREA/ CODE	VERB	LINK A	LINK B
	Science 493	Measures	Mass/weight	
	Science 047	Applies/Uses	Scientific method	Observations
	Language Arts 042	Collects/ Organizes	Information-written/oral	Notes
	Mathematics 015	Calculates/ Evaluates	Percent	In/decrease/ markup/ discount
	Mathematics 174	Interprets	Charts/tables graphs	
	Language Arts 147	Comprehends	Information-written	Sequence
OBJECTIVE 20c	Language Arts 035	Attends	Directions/ task	
	Mathematics 185	Measures	Direct	Weight
	Science 493	Measures	Mass/weight	
	Language Arts 147	Comprehends written	Information-	Sequence

INFORMATION SHEET

GRAIN PRODUCTS VIII

OBJECTIVE 1

Match terms associated with grain products to their correct definitions.

- **Cereal grain**—The seed of grasses cultivated for human or animal food
- **Pesticide**—Any compound dry or wet that is found to kill pests
- **Pest**—Any insect, disease, or plant that competes with humans or domestic animals for food or water
- **Weed**—Any plant growing where it is not wanted
- **Bacteria**—Microscopic, one-celled organisms
- **Virus**—Microscopic infective agents that are capable of growth only in living cells; responsible for diseases in plants and animals
- **Gluten**—A tough, sticky mixture of plant proteins obtained by washing out the starch from wheat or other cereal flour and used as adhesive and thickener
- **Centrifuge**—A rotary machine for the separation of substances having different weights by spinning them away from the center
- **Fumigation**—A process of disinfecting using gas-like substances
- **Aeration**—Artificial movement of air currents used to cool, but not to dry, grain in storage
- **Organic**—Capable of growing and developing
- **Abrasive**—Designed to wear away a surface by the use of friction

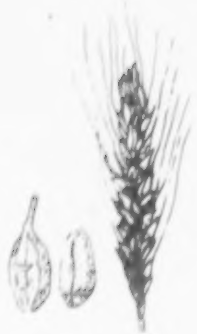
  NOTE: Abrasives work by rubbing the grain. Abrasive discs are used to remove the bran from rice.

- **Protein**—A highly complex series of amino acids occurring in all animal and vegetable matter, essential for the growth and for the life of animals and people; needed for muscles and tissues

- **Carbohydrates**—A combination of starches and sugars; essential for energy

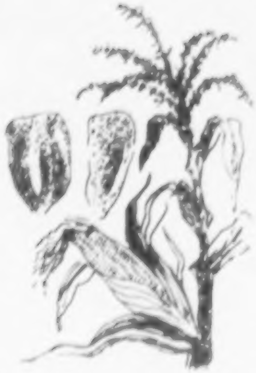
- **Vitamins**—Complex organic substances found in various foods and vegetables; essential for the normal functioning of the body

OBJECTIVE 2 **Label types of grains.**



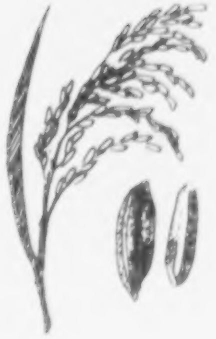
Wheat
- lifted ends
- extremely hard hull

NOTE: Durum, hard, red, soft winter, spring wheat will have similar basic characteristics but there will be slight differences in color, shape, length of seed.

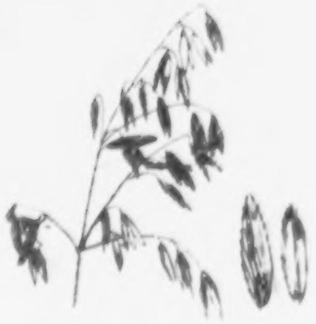


Corn
- dented end
- cleft

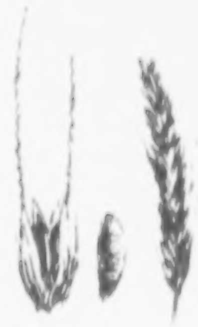
NOTE: Common varieties are field corn, sweet corn, and popcorn.



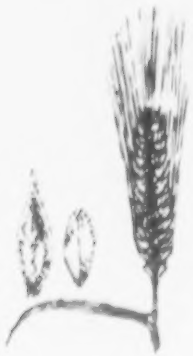
Rice
- tufted end
- "banana shaped" hull



Oats
- tufted end
- length of seed



Rye
- tufted end
- rounded sections under bran



Barley
- tufted end
- cleft

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OBJECTIVE 3 **State the function of parts of the grain.**

- **Endosperm**—Food storage part of the seed containing protein and starch.

  NOTE: The protein and starch are the food supply for the growing seed. The endosperm is the part of the grain most readily processed into flour and breakfast flakes.

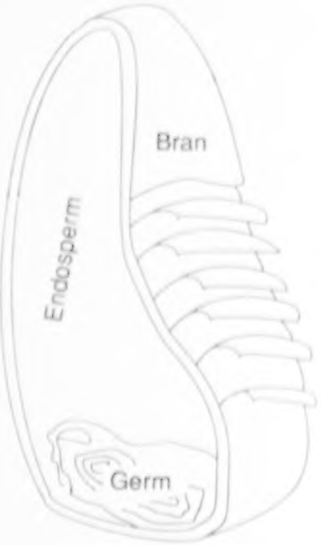
- **Germ**—The reproductive part of the seed, contains vitamins and minerals.

  NOTE: The germ is a rich source of vitamin E. It is usually removed before the grain is processed. If the germ is left in, the grain may grow rancid.

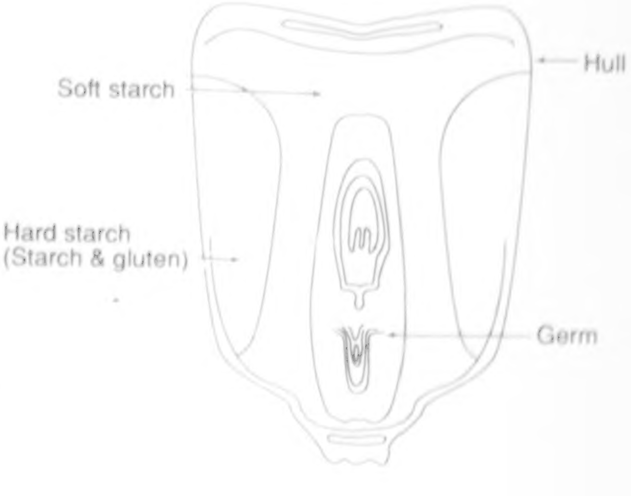
- **Hull or bran**—Hard, protective covering on a grain seed; contains vitamins and minerals.

  NOTE: The hull is rich in B vitamins and iron. It must be cracked to be digestible. To be mill-ready for flour, the hull must be removed.

OBJECTIVE 4 **Label parts of grain.**



Wheat



Corn

OBJECTIVE 5

Distinguish among characteristics of common grains used for human consumption.

All of these grains are cereal grains, and can be fed to animals.

- WHEAT
  - Chief breadstuff of temperate climates
  - Yields a fine white flour when milled
  - Used for bread, pastas, breakfast cereals, pastries
- CORN
  - Yields a kernel that may be eaten unmilled
  - Yields a meal when milled
  - Processed to make sweeteners
- RICE
  - Seed is eaten intact with only hull, bran, and germ removed
  - Chief foodstuff of Asian countries
- BARLEY
  - Usually sold as pearl barley with the bran removed; used in soup
  - Barley flour is used in baby foods, cereals
- OATS
  - Grown chiefly for animal feed
  - Usually sold as rolled oats for human consumption
- RYE
  - Grown chiefly for animal feed
  - Makes rye bread when milled into flour and mixed with white wheat flour

OBJECTIVE 6

Match types of wheat flour to their descriptions.

- **White flour**—Milled and sifted wheat; may be bleached or unbleached
- **Whole wheat flour**—Milled wheat in which the natural parts of the wheat grain remain unaltered
- **Enriched flour**—White flour to which the B vitamins thiamin, riboflavin and niacin and the mineral iron have been added; calcium and vitamin D may also be added

- **Self-rising flour**—Flour to which a leavening agent and salt have been added

  NOTE: Leavening is a substance such as baking powder, baking soda or yeast, that makes bread dough rise.

- **Durum flour**—Flour made from hard red wheat; high in protein; used for pasta

OBJECTIVE 7

Name types of flour according to their uses.

- **All-purpose flour**—A blend of hard and soft wheats which contain a moderate amount of gluten (protein); used for making breads, pastries, cookies and cakes.

- **Bread flour**—Milled from hard wheat and fairly high in protein; used mainly by bakeries.

- **Cake flour**—Milled from soft wheats and fairly low in protein content; soft and silky; used for baked products, especially cakes.

OBJECTIVE 8

Match types of milling processes to their descriptions. (Supplement 3)

- **Ground**—Grain is reduced to powder or to small particles by friction; rollers work against one another with grain between them

  EXAMPLES: All flours, corn meal

- **Cracked**—Hull is removed, bran is split open but granules are larger than required for meal or flour

  EXAMPLES: Cracked wheat, corn

- **Rolled**—Endosperm is broken then pressed flat; used as cooked cereal and cookie-making products

  EXAMPLE: Oats, wheat and other grains. Oatmeal is made from rolled oats.

- **Sieved**—Finer materials are sorted from coarser materials using meshes of various sizes

  NOTE: When grains are milled, the hull, bran, and germ are removed by using sieves.

OBJECTIVE 9

Identify grains according to their standard milling process.

- **Wheat**—Milled by placing the grain seeds between a series of rollers that are set closer and closer together as the product becomes flour. Between each set of rollers the grain is sieved to remove bran and germ. Each successive rolling and sieving yields a finer, whiter flour.

  NOTE: Vitamins and minerals are removed with the bran and the germ.

- **Rice**—Milled by feeding whole grains of rice, by machine, between abrasive discs or moving rubber belts. The outer hull is rubbed from the kernel and the hull is then blown away by jets of air. The remaining kernels are known as brown rice. Further rubbing to remove the remaining bran and germ yields white rice.

- **Corn**—May be eaten as whole kernels without milling. When it is milled, two methods are used:

  - Dry milling—The corn is passed through special rotating cords to loosen hulls and germ. The mixture is dried to facilitate subsequent roller milling and sieving, the hulls are blown away, and the process continues as for wheat.

  - Wet milling—The cleaned corn is wet in large tanks, run through a mill to break up the kernel, pumped to a settling trough where germ is skimmed off to make oil. The remaining product is screened to remove the hulls, then put through high-speed centrifuges where starch and protein are separated. Further processing yields meal, dry starches, and various corn sweeteners.

  NOTE: Oats do not require extensive milling processes associated with wheat and corn.

OBJECTIVE 10

Select from a list true statements about the essential nutrients found in grains.

Whole grains are rich in vitamins, minerals, proteins and carbohydrates. Some grains, especially corn, are also rich in fats. Most of the vitamins, minerals, and the protein are found in the germ and the bran of the grain. These are the parts removed in the milling process (See box).

- Proteins—Build muscle and tissue

- Carbohydrates and fats—Provide energy

- Vitamin A—Promotes healthy skin and good night vision
- Vitamin B (thiamine)—Essential for healthy nerves and the prevention of the disease beriberi

  NOTE: Beriberi is characterized by extreme weakness, anemia, wasting away to death. To prevent this disease Vitamin B is added to grain products.

- Vitamin B_2 (riboflavin)—Essential for normal growth and healthy hair
- Vitamin B_6 (pyridoxine)—Essential for stable nerve and muscle function
- Vitamin B_{12}—Essential for coping with stress

Studies are being conducted to determine the body's need for proteins and the value of grains in supplying that need. There is concern on the part of some nutritionists that as the population grows, too much of the world's grain production is fed to animals to produce meat. Their question is, "May humans use the grain proteins as effectively as meat protein for the body's health and growth?"

Wheat that is milled into fine white flour is composed mostly of starch and some protein. *Enrichment* (adding the vitamins and minerals that were milled out) replaces some, but not all of the substances that were removed from finely milled flour.

Proteins, vitamins, and minerals that are present in rice are removed as the rice is polished. *Converted rice* has had the minerals and vitamins leached into the endosperm by a steam heating process before the hull is removed. (Leached means the water soaked the minerals and vitamins into the endosperm.) *Enriched rice* has had the minerals and vitamins added then sealed to the rice seed by an edible coating that does not dissolve in water.

- Vitamin C—Essential for healthy gums and a healthy immune system

  NOTE: The body does not store Vitamin C and requires daily intake from food or vitamin supplements.

- Vitamin D—Essential for healthy bones and teeth

  NOTE: The sun supplies some vitamin D requirements.

- Vitamin E—Essential for proper healing and correct function of the heart, among a great number of other uses

OBJECTIVE 11

List products made from common grains for human consumption. (Supplement 1, Supplement 4)

- WHEAT
  - Spaghetti
  - Noodles
  - Macaroni
  - Bread products
  - Bulgor (cracked wheat)
  - Crackers
  - Pastries
  - Breakfast cereal
- RICE
  - Cereal
  - Cakes
  - Vinegar
  - Flour (for people with wheat allergies)
  - Sweetener
  - "As is" with hull/bran, and germ removed
- CORN
  - Chips
  - Tortillas
  - Muffins (corn meal)
  - Sweeteners: syrup, dextrose, dextrin
  - Cornstarch
  - Breakfast cereals
- BARLEY
  - Malt flavorings (crackers, cookies, etc., malted mile)
  - Pearls (soup) (whole seeds)
  - Flour (baby foods)

  NOTE: Barley sprouted for beverages (malt) must be free of pesticides.

- OATS
  - Rolled (cereal)
  - Cookies
  - Filler
  - Bran

OBJECTIVE 12 **List criteria for high grade wheat.** (Supplement 5)

High-grade wheat

- Has a good natural odor
- Is dry and clean, plump and heavy
- Is not mixed with wheat of another class
- Does not contain damaged or shrunken grains
- Is free of smut and injurious insects

OBJECTIVE 13 **Select from a list true statements about requirements for grain storage.**

NOTE: Stored grain is a living, breathing, organic mass.

- **Storage temperature and aeration**—Must be carefully controlled to guard against damage by insects, heat, mold and sprouting.
  - Insects thrive when the temperature of the stored grain is between 70-85°F (21°-32°C); they can't live above 90° F (32°C).
  - Careful aeration reduces the temperature and discourages the insect population when summer temperatures fall below 90°F (32°C).
  - Aeration helps control the moisture content of grain. Molds and insects thrive when moisture content rises above 13%.
  - When moisture content is too high grain can sprout in storage.
- **Maintenance**—Regular checks on the stored grain are necessary even though grain has been cooled and moisture seems controlled.

  - Insects may find "pockets" where they supply their own heat and moisture to survive.

  - Moisture "migrates" and may cause problems of mold, insect, and sprouting damage.

OBJECTIVE 14 **Discuss the use of chemical controls.**

- Chemical controls are less expensive, faster, and more effective for controlling insects, weeds, and diseases than alternate controls available at the present time. Careful and safe use of chemicals reduces the dangerous and undesirable effects associated with their use.

- A growing world population puts severe strain on the food supply. In the U.S. and in other countries, agricultural land is giving way to other land uses such as housing developments and industry. We must make the best possible use of all producing land.

- More kinds of insects live on earth than all other animals combined. Without some type of control, the loss of crops from insect damage would raise food costs to a prohibitive level.

- Weeds reduce crop yields, increase production costs, and lower the quality of crop products.

- While alternative methods are available for controlling insects and weeds, the only effective disease control at the present time is to chemically treat seeds for disease resistance.

- Manufacturers and the government constantly monitor chemical products, their use, and their effects.

OBJECTIVE 15 **Complete statements concerning U.S. grain markets.** (Supplement 2)

- Marketing of grain depends on the supply of the product and the demand for it.

- Influences of supply and demand govern the need to make storage decisions.

- Domestic (U.S.) markets consume most of the rice, barley, rye, and oat production.

- Wheat is the biggest grain export.

- Most of the wheat exported is under a government-subsidized plan.

  In 1989, Egypt was main benefactor under Public Law-480. Wheat is also exported to Japan, China, Russia and to the European Common Market which is comprised of Belgium, France, Italy, Luxembourg, the Netherlands, West Germany, Great Britain, the Republic of Ireland, Denmark, Greece, Spain, and Portugal.

- Corn is exported to Russia (Soviet Union) to be fed to their cattle. Russian producers are concentrating on improving their herds with American grain.

- While the U.S. is a major world producer of grains, it also imports grains as part of reciprocating agreements with other countries.

OBJECTIVE 16 **List nonfood uses for grain products.**

An efficient flour mill manager will use all of the grain product that enters the mill.

- Starches are used to make adhesives for industry.

- Starches are used in plastic films to make them biodegradable.

- Grain products, especially corn, may be fermented to produce alcohol which is then combined with gasoline to make gasohol which can be burned in automobiles.

  NOTE: Gasohol is widely used in Brazil at the present time and is popular in Nebraska. Gasohol uses a valuable food resource. There is concern that extended use will create a corn shortage, drive food prices higher, and threaten the general welfare in countries where the populations are starving.

- Ergot, a common grain disease, provides an alkaloid used in making medicine to treat severe migraine headaches.

  NOTE: An alkaloid is a substance found in living plants that can combine with acids to form salts. Alkaloids are used to make other medicines such as morphine and quinine. The poison strychnine is made from an alkaloid.

- Organic gardeners use straw mulch to help control weed growth in gardens and to help the land retain moisture. Grain hulls are used by landscape gardeners to control weeds, serve as mulch and to enhance the beauty of plantings.

GRAINS AND HUMAN NUTRITION

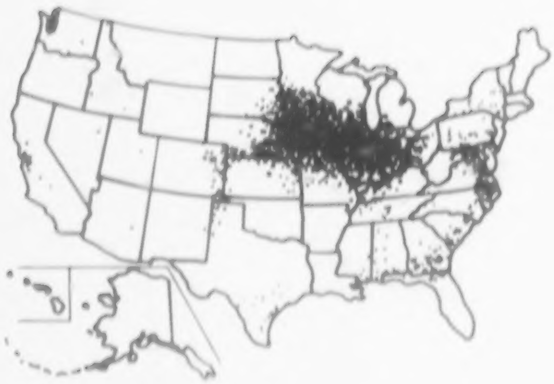
Human nutrition has been studied for many years. Recently, many people have been persuaded that fine, easy-eating products are not healthy foods. Minerals, vitamins, and hull fiber removed in grain processing are now either allowed to remain in less-refined products or are added as enrichment.

Chief minerals added are calcium and iron. Chief vitamins added are A, C, B_1, B_6, and B_{12}.

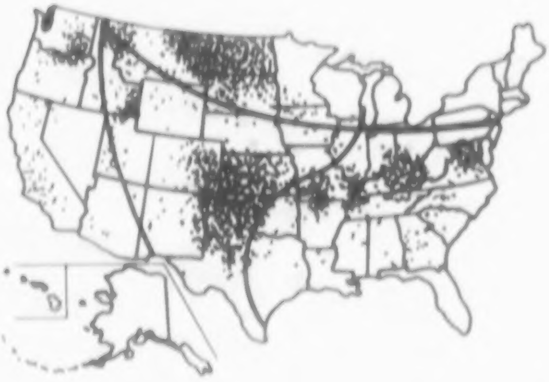
"Enriched" rice is hulled, polished, then coated with a mixture of vitamins and minerals. This coating is covered with an edible waterproof material. So, rice washed before cooking retains the added minerals and vitamins.

"Converted" rice is parboiled whole rice. The rice is soaked in water kept at 158° F (70°C) for 10 hours. The hulls are not removed. The vitamins and minerals leach into the endosperm. The rice is then dried and milled. Rice is enriched by adding a powdered supplement.

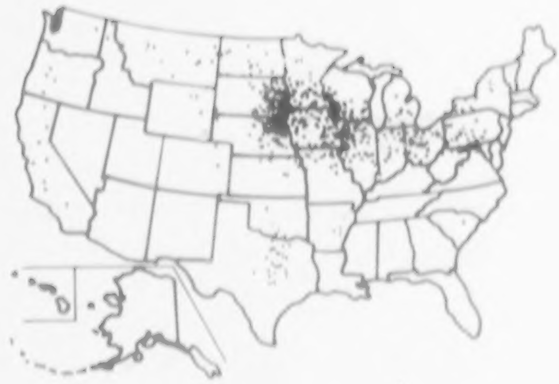
DISTRIBUTION OF HARVESTED GRAIN IN THE UNITED STATES



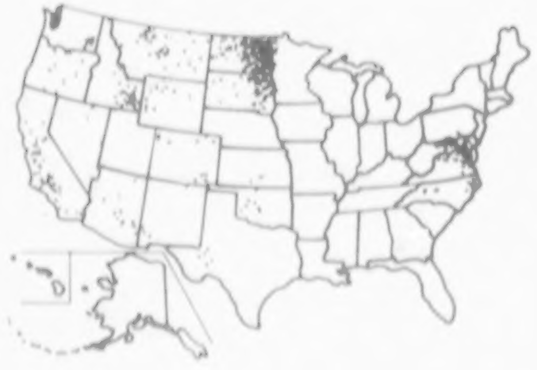
Corn



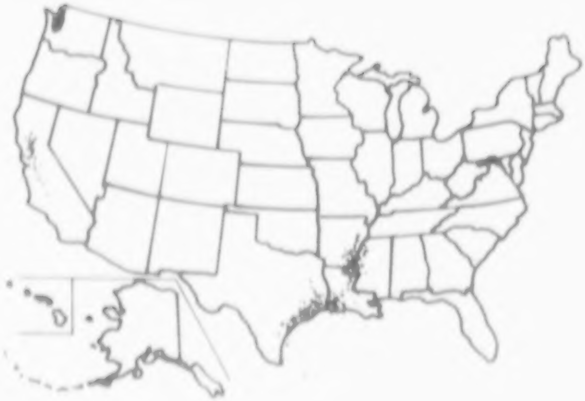
Wheat



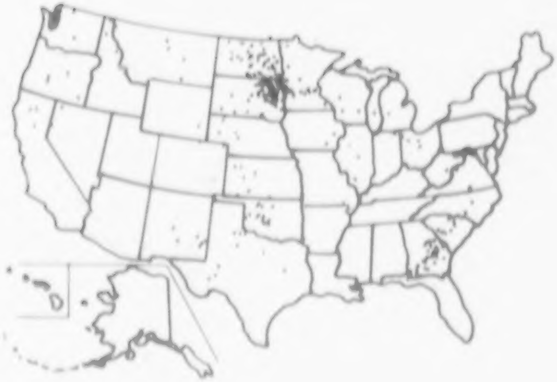
Oats



Barley



Rice



Rye

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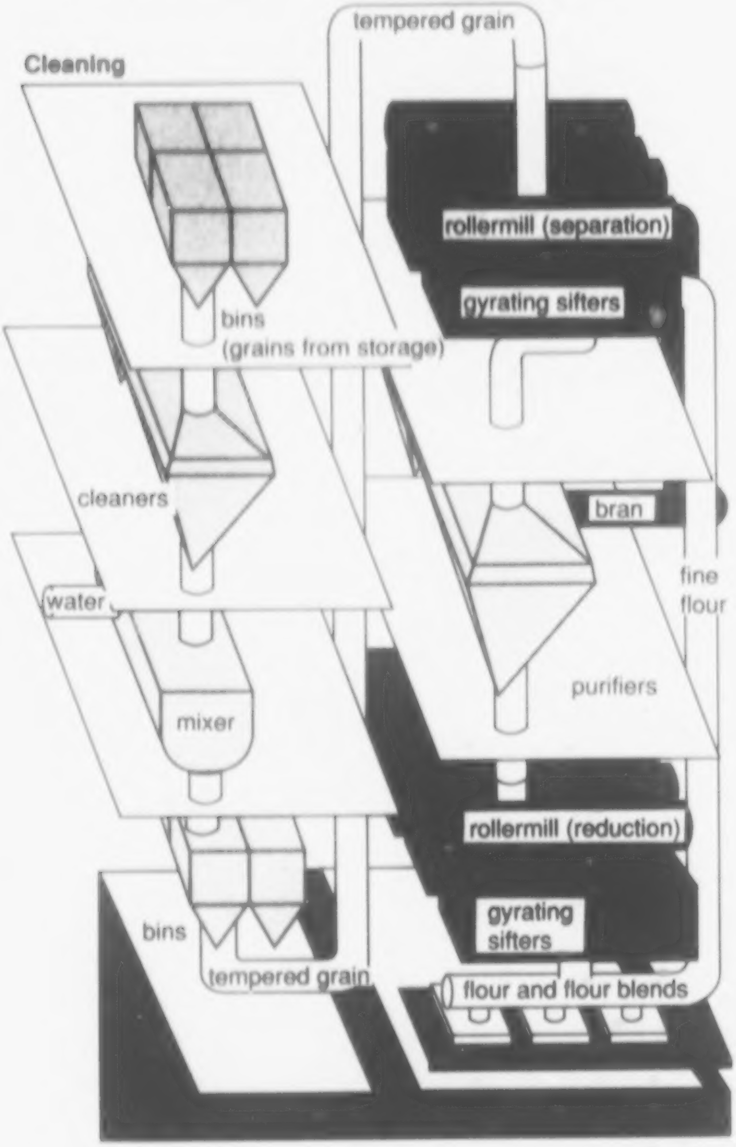
COMMERCIAL FLOUR MAKING


tempered grain
Cleaning
rollermill (separation)
gyrating sifters
bins
(grains from storage)
cleaners
bran
fine
flour
water
purifiers
mixer
rollermill (reduction)
gyrating
sifters
bins
tempered grain
flour and flour blends

The flour milling process begins with cleaning the grain and tempering it by adding water. The tempered grain is ground in a series of rollermills to remove the bran and to cut up the endosperm. Between each rollermill cycle, the ground grain is sifted and separated into various sizes. Middle-size material is sent to a purifier, or shaking sifter, and on to another set of rollermills for further reduction and sifting into a variety of flours and flour blends. These are then stored in large bins before shipment.

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LESSER KNOWN GRAIN PRODUCTS

- Bulgur wheat—Cracked wheat used in making tabouli.
- Russian rye—Specialty rye bread usually made with caramel coloring.
- Phyllo or filo (FEE-lo) dough—Used to make fine, light layers of crust for foods such as strudel and pastries; especially used in Greece, Germany, the Middle East and Eastern Europe.
- Couscous (Koos-koo)—Semolina wheat used in pilaf; Imported from France and the Middle East.
- Rice cakes—A variety of round or square flat snack foods made from puffed rice.
- Sweeteners—Brown rice syrup, barley malt syrup, sucrose and fructose/corn syrup, and Amasaki (rice sweetener).
- Fiber products—Oat bran, wheat bran.
- Cream of Buckwheat—Buckwheat was thought of as "the poor man's crop" and is just now enjoying a comeback because of its nutritional values.
- Amaranth (AM-uh-ranth)—A protein-rich grain used by ancient Central Americans and Southwest U.S. Indians. Rediscovered in the 1970's, it is a popular health-food cereal grain.
- Triticale (trituh-KAH-lee)—Used world-wide, triticale is growing in popularity as a cereal in the U.S.
- Kash or kasha—A combination of all or some of these grains: slightly hulled whole oats, long grain brown rice, rye, hard red winter wheat, triticale, raw buckwheat, and barley. Kash is made in California with American-grown grains.
- Orzo—Macaroni product with semolina (made from durum wheat).
- Grits—Coarsely ground corn. Cooked as a cereal.

- Pilaf (PEE-loff)—Parboiled long grain rice, orzo and other ingredients. Rice is grown in Arkansas, California, Louisiana, and Texas.

- Basmati Rice—Aromatic, long-grain rice originally from India. Products available are crossed with Texas long grain rice.

UNITED STATES STANDARDS FOR WHEAT

Grades and Grade Requirements

§ 810.2204 Grades and grade requirements for wheat.

(a) Grades and grade requirements for all classes of wheat, except Mixed wheat.

Grade	Minimum limits of —		Maximum limits of —						
	Test weight per bushel		Damaged kernels					Wheat of other classes[4]	
	Hard Red Spring Wheat or White Club wheat[1] (pounds)	All other classes and subclasses (pounds)	Heat damaged kernels (percent)	Total[2] (percent)	Foreign material (percent)	Shrunken and broken kernels (percent)	Defects[3] (percent)	Contrasting classes (percent)	Total[5] (percent)
U.S. No. 1	58.0	60.0	0.2	2.0	0.5	3.0	3.0	1.0	3.0
U.S. No. 2	57.0	58.0	0.2	4.0	1.0	5.0	5.0	2.0	5.0
U.S. No. 3	55.0	56.0	0.5	7.0	2.0	8.0	8.0	3.0	10.0
U.S. No. 4	53.0	54.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
U.S. No. 5	50.0	51.0	3.0	15.0	5.0	20.0	20.0	10.0	10.0

U.S. Sample grade:

U.S. Sample grade is wheat that:

(a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or

(b) Contains 32 or more insect-damaged kernels per 100 grams of wheat; or

(c) Contains 8 or more stones or any number of stones which have an aggregate weight in excess of 0.2 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (Crotalaria spp.), 2 or more castor beans (Ricinus communis L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 2 or more rodent pellets, bird droppings, or equivalent quantity of other animal filth per 1,000 grams of wheat; or

(d) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

(e) Is heating or otherwise of distinctly low quality.

---

[1] These requirements also apply when Hard Red Spring wheat or White Club wheat predominate in a sample of Mixed wheat.

[2] Includes heat-damaged kernels.

[3] Defects include damaged kernels (total), foreign material, and shrunken and broken kernels. The sum of these three factors may not exceed the limit for defects for each numerical grade.

[4] Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.

[5] Includes contrasting classes.

United States Standards for Wheat

(b) *Garlicky wheat.* Wheat that contains in a 1,000 gram portion more than two green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.

(c) *Light smutty wheat.* Wheat that has an unmistakable odor of smut, or which contains in a 250 gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 14 smut balls, but not in excess of a quantity equal to 30 smut balls of average size.

(d) *Smutty wheat.* Wheat that contains, in a 250 gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size.

(e) *Treated wheat.* Wheat that has been scoured, limed, washed, sulfured, or treated in such a manner that the true quality is not reflected by either the numerical grades or the U.S. Sample grade designation alone.

UNITED STATES STANDARDS FOR CORN

Principles Governing the Application of Standards

§ 810.403 Basis of determination.

Each determination of class, damaged kernels, heat-damaged kernels, waxy corn, flint corn, and flint and dent corn is made on the basis of the grain after the removal of the broken corn and foreign material. Other determinations not specifically provided for under the general provisions are made on the basis of the grain as a whole, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from broken corn and foreign material.

Grades and Grade Requirements

§ 810.404 Grades and grade requirements for corn.

Grade	Minimum test weight per bushel (pounds)	Maximum limits of –		
		Damaged kernels		Broken corn and foreign material (percent)
		Heat damaged kernels (percent)	Total (percent)	
U.S. No. 1	56.0	0.1	3.0	2.0
U.S. No. 2	54.0	0.2	5.0	3.0
U.S. No. 3	52.0	0.5	7.0	4.0
U.S. No. 4	49.0	1.0	10.0	5.0
U.S. No. 5	46.0	3.0	15.0	7.0
U.S. Sample grade –				

U.S. Sample grade is corn that:

(a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or

(b) Contains 8 or more stones which have an aggregate weight in excess of 0.20 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cockleburs (*Xanthium* spp.) or similar seeds singly or in combination, or animal filth in excess of 0.20 percent in 1000 grams; or

(c) Has a musty, sour, or commercially objectionable foreign odor; or

(d) Is heating or otherwise of distinctly low quality.

Special Grades and Special Grade Requirements

§ 810.405 Special grades and special grade requirements.

(a) *Flint corn.* Corn that consists of 95 percent or more of flint corn.

(b) *Flint and dent corn.* Corn that consists of a mixture of flint and dent corn containing more than 5.0 percent but less than 95 percent of flint corn.

(c) *Waxy corn.* Corn that consists of 95 percent or more waxy corn, according to procedures prescribed in FGIS instructions.

IDENTIFY LESSER KNOWN GRAIN PRODUCTS AT THE GROCERY STORE

Visit supermarket, health, and international food stores to identify grain products.

1. See lesser known products such as:
    - Cream of buckwheat
    - Amaranth flakes/flour
    - Varieties of rice (long grain, short grain, converted, enriched, brown, instant, white)
    - Rice cakes and rice flour
    - Russian rye/flour
    - Phyllo (filo)
    - Couscous
    - Others
2. Read labels on snack products to identify the grains.
3. Read labels on snacks, beverages and bakery products to identify the sweeteners used and the corn/rice/barley content.
    - Brown rice syrup—Cooked brown rice + sprouted barley
    - Barley malt syrup—Soaked/sprouted and/or hot air-dried barley + water cooked to syrup consistency
    - Sucrose/fructose from corn—Dextrin, dextrose
    - Amasaki (amazake)—Found in the macrobiotic section of health food store

ASSIGNMENT SHEET 1

GRAIN PRODUCTS

VIII

NAME ______________________________ SCORE ________

OBJECTIVE 17 **Identify common grains.**

INTRODUCTION Six of the principal cereal grains grown in the United States are corn, wheat, oats, barley, rye, and rice. As a student of agriculture products and processing, you should be able to identify them on sight. This assignment sheet asks you to draw the grain as in Objective 2 so that you learn to distinguish them from one another.

DIRECTIONS Part 1

Draw a picture of each grain as in Objective 2.

corn

wheat

oats

rye

barley rice

Part 2

Use your drawing to help identify grains provided by your teacher. Write the name of the grain and a brief description.

1. ______________________________

____

____

2. ______________________________

____

____

3. ______________________________

____

____

4. ______________________________

____

____

5. ______________________________

____

____

6. ______________________________

____

____

ASSIGNMENT SHEET 2

GRAIN PRODUCTS

VIII

NAME ______________________________ SCORE ________

OBJECTIVE 18 **Identify corn sweeteners used in snack foods.**

INTRODUCTION Wet-milling of corn yields several corn sweeteners. Corn syrup, fructose, dextrose, and dextrin are the most common. As you investigate food products and the corn sweeteners used in them you will gain a greater appreciation of how important grains are to American tastes and eating habits.

DIRECTIONS Look at ten packages, bottles, or boxes of snack foods. List the product by brand name and the sweetener or sweeteners used.

	Product	Sweetener
1.	____________________	____________________
2.	____________________	____________________
3.	____________________	____________________
4.	____________________	____________________
5.	____________________	____________________
6.	____________________	____________________
7.	____________________	____________________
8.	____________________	____________________
9.	____________________	____________________
10.	____________________	____________________

ASSIGNMENT SHEET 3 — GRAIN PRODUCTS — VIII

NAME ______________________________ SCORE _______

OBJECTIVE 19 **Solve a dockage problem.**

INTRODUCTION

Dockage is the amount by weight of weed seeds, weed stems, chaff, straw, sand, dirt, and any grain or material other than wheat, which can be removed readily by use of appropriate sieves ("Other material" may be called foreign material or FM.). Cheat is a frequent problem. It is a weed that infests crops and significantly lowers the quality and value. Dockage means a significant dollar loss for the farmer. A small percentage of foreign material is permissible.

Mr. Smith's 900 bushels of wheat has tested unacceptably high in cheat. The elevator docks 3% from the total weight. The price per bushel is $3.50. How much does Mr. Smith lose on this load?

To solve:

1. Calculate full price of load
2. Determine percentage of loss (dockage)
3. Subtract percentage of dockage from full price of load
4. Record result to determine actual return on load

Formula:

(number of bushels x price per bushel) - (percentage x full price) = dockage

EXAMPLE: 900 bushels x $3.50 = $3,150
.03 dockage x $3,150 = $94.50 loss
$3,150 - $94.50 = $3055.50 final price

DIRECTIONS

Mr. Smith has 1500 bushels of wheat from that same crop with too much cheat in it. This time the elevator docks 4% from the total weight. The price per bushel is $3.50. How much does Mr. Smith make on the sale and how much is his loss? Show your work.

Mr. Smith's loss ___________ Mr. Smith's final price ___________

ASSIGNMENT ANSWERS

GRAIN PRODUCTS

VIII

ASSIGNMENT SHEET 1

Part 1

Students should draw the correct grain in the correct blank.

Part 2

Students should identify the grains in the order you have presented them. Descriptions should include correct spelling and grammar and an appropriate description of the grain.

ASSIGNMENT SHEET 2

Answers should list ten products by brand name and their sweeteners.

ASSIGNMENT SHEET 3

Mr. Smith's loss was $210 Mr. Smith's final price was $5,040
1500 x $3.50 = $5,250.00

$\frac{4}{100}$ or .04 x $5,250 = $210 loss

$5,250 - $210 = $5,040

JOB SHEET 1 | GRAIN PRODUCTS | VIII

OBJECTIVE 20a

Clean a sample of grain.

INTRODUCTION

You may choose corn or wheat. The hand-sieving method used here is not the method used by licensed official grain inspectors. Hand sieving is a method used since ancient times to separate the grain from the chaff.

Grain samples are cleaned to determine the dockage.

TOOLS AND MATERIALS

- Clean, white 4 foot square piece of sheeting
- 1000 grams or 2 quarts of grain to be sampled
- Scale
- Weighed containers
- 12/64 round-hole sieve for corn, 5/64 round-hole sieve for wheat

PROCEDURE

NOTE: Perform the entire job over the white sheeting.

1. Weigh two empty containers.
2. Record the weight on the Dockage Record.
3. Weigh 1000 grams (or 2 quarts) of wheat or corn for the sample.
4. Record the weight.
5. Divide the sample into four 250-gram samples.
6. Sieve one 250 gram sample through a 12/64 screen for corn, or a 5/64 screen for wheat.
    a. Hold sieve level, with both hands, directly in front of the body and the elbows close to your sides.
    b. Move grain lengthwise with the perforations.
    c. Move the sieve steadily right to left approximately 10 inches, then left to right 10 inches without stopping.
    d. Repeat 30 times.

7. Repeat with each sample following steps 1-6.
8. Pick out all material that is not corn from sieve. This is foreign material (FM).
9. Add foreign material to material that passed through the sieve.
10. Weigh to determine the percentage of broken kernels and foreign matter.
11. Use this formula to determine the percentage of broken kernels and foreign matter; weight of sieved broken kernels and foreign matter divided by the total weight of sample.
12. Record percentage.

    NOTE: If percentage is over 4%, grain is discounted.
13. Have your instructor check your work.
14. Clean area and put away tools.

Dockage Record

Weight of empty containers ____________________

Sample #1

Weight of sample ____________________

Weight of broken kernels and foreign matter __________

Percentage of broken kernels and foreign matter __________

Sample #2

Weight of sample ____________________

Weight of broken kernels and foreign matter __________

Percentage of broken kernels and foreign matter __________

Sample #3

Weight of sample ____________________

Weight of broken kernels and foreign matter __________

Percentage of broken kernels and foreign matter __________

Sample #4

Weight of sample ____________________

Weight of broken kernels and foreign matter __________

Percentage of broken kernels and foreign matter __________

I certify that I have cleaned this grain and determined the percent of dockage.

____

Student Instructor

OBJECTIVE 20b

Grade a sample of wheat.

INTRODUCTION

The old saying that "wheat is wheat" has often been given as a reason why every bushel of wheat should sell at the same price. But buyers and sellers know that higher prices are paid for the better grades of many farm products, and wheat is no exception. Accurate, definite, reliable grade determination is essential to marketing wheat. Accurate grading is of particular importance to the export market.

- The six grades of wheat are Numbers 1 through 5 and Sample.
- Number 1 and Number 2 are the best grades for milling and for breakfast cereals.

NOTE: Shrunken and broken kernels affect the grade. If the sample is more than three percent shrunken and broken kernels, the grade can not be higher than USDA #2.

TOOLS AND MATERIALS

- 1000 grams or 2 quarts of wheat
- Clean, white 4 foot square piece of sheeting
- Graduated sieves (5 or 6) with finest measurement 5/64"
- Weighed containers for wheat
- Scale
- Container (also weighed) for dockage
- Labels and pen
- Grade chart

PROCEDURE

NOTE: Do procedure on the white material.

1. Obtain 1000 gram or 2 quart sample.
2. Check for odors.
3. Check for unusual conditions such as rodent or bird droppings and unknown foreign material.
4. Divide sample into four 250-gram sections and label.
6. Record weight of container with sample.
6. Record weight of container empty.
7. Sieve sample as often as necessary to remove dockage.

   NOTE: See Job Sheet 1 for sieving procedures.
8. Weigh dockage.
9. Calculate percentage of sample that is dockage.

   NOTE: A moisture test must be made at this point. However, most classrooms do not have the electronic equipment that commercial mills own.
10. Weigh dockage-free sample.
11. Determine number of broken, shrunken kernels in the sample.
12. Calculate percentage of damaged kernels.
13. Consult the chart in Supplement 5 that tells the percentage of damaged, shrunken kernels, and foreign matter allowed each grade.
14. Have your instructor check your work.
15. Put away tools and clean work area.

Grading Records

Weight of container(s) used ______________________________

Sample #1

Total weight of sample ______________________________

Weight of dockage ______________________________

Calculate percentage of dockage ______________________________

Weight of damaged, shrunken kernels and FM (other seeds) ____

Calculate percentage of broken kernels and FM ____________

Grade of sample ______________________________

Sample #2

Total weight of sample

Weight of dockage ______________________________

Calculate percentage of dockage ______________________________

Weight of damaged, shrunken kernels and FM (other seeds) ____

Calculate percentage of broken kernels and FM ____________

Grade of sample ______________________________

Sample #3

Total weight of sample ______________________________

Weight of dockage______________________________

Calculate percentage of dockage ______________________________

Weight of damaged, shrunken kernels and FM (other seeds) ____

Calculate percentage of broken kernels and FM ____________

Grade of sample ______________________________

Sample #4

Total weight of sample ____________________

Weight of dockage ____________________

Calculate percentage of dockage ____________________

Weight of damaged, shrunken kernels and FM (other seeds) ____

Calculate percentage of broken kernels and FM ________

Grade of sample ____________________

I certify that I have graded this sample of wheat and found it to be as noted.

Grader Supervisor

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JOB SHEET 3

GRAIN PRODUCTS

VIII

OBJECTIVE 20c

Process wheat into flour.

TOOLS AND MATERIALS

- 5-10 pounds wheat grain
- Steel- or stone-wheel grinder
- Bowl to receive flour
- Scales

PROCEDURE

NOTE: Observe that flour obtained is not the white flour we know, but a heavier, whole-wheat flour.

1. Read manufacturer's instructions for operating the grinder.
2. Weigh the bowl and record the weight or set the scale to the weight of the bowl.
3. Tightly secure the grinder to a bench or table.
4. Place grain where it can be easily reached and bowl where it will receive the flour from the grinder.
5. Place flour in receiving hopper according to manufacturer's directions.
6. Turn crank slowly, with a steady pressure.

   CAUTION: Cranking too fast or with a jerking motion will break the grinder.

7. Continue grinding until you have 1 pound of whole-wheat flour.
8. Have your instructor check your work.
9. Put away tools and clean the work area.

OBJECTIVE 20a

Clean a sample of grain.

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	YES	NO
1. Weighed the empty containers.	_____	_____
2. Recorded the weight.	_____	_____
3. Weighed 1000 grams (or 2 quarts)	_____	_____
4. Recorded the weight.	_____	_____
5. Divided the sample into four 250-gram parts.	_____	_____
6. Sieved 1/4 of sample through 12/64 sieve for corn or 5/64 sieve for wheat.	_____	_____
a. Held sieve level, with both hands, directly in front of the body and the elbows close to the sides.	_____	_____
b. Moved grain lengthwise with the perforations.	_____	_____
c. Moved the sieve steadily right to left approximately 10 inches, then left to right 10 inches without stopping.	_____	_____
d. Repeated 30 times.	_____	_____
7. Repeated sieving with each sample following steps 1-6.	_____	_____
8. Hand-picked out all material not grain sampled.	_____	_____
9. Added the foreign material to material sifted out.	_____	_____

The student:	YES	NO
10. Weighed the foreign material and material sifted out.		
11. Used the formula to calculate the percentage of broken kernels and foreign material in the sample.		
12. Recorded the percentage.		
13. Used proper tools correctly.		
14. Performed steps in a timely manner.		
15. Practiced safety rules through procedure.		
16. Provided satisfactory responses to questions asked.		
17. Put away tools and cleaned work area.		

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Used proper weighing procedures	4	3	2	1
Used correct sieving procedures	4	3	2	1
Recorded data correctly	4	3	2	1
	4	3	2	1

EVALUATOR'S COMMENTS

____

____

____

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

OBJECTIVE 20b

Grade a sample of wheat.

Student's name ______________________________ Date ____________

Evaluator's name ____________________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	YES	NO
1. Took an adequate sample.	______	______
2. Kept all procedures on the white sheet.	______	______
3. Checked the sample for odors.	______	______
4. Checked the sample for any unusual condition.	______	______
5. Divided the sample into four (4) equal parts.	______	______
6. Weighed the container empty.	______	______
7. Recorded weight of empty container.	______	______
8. Weighed the sample.	______	______
9. Recorded weight of container.	______	______
10. Sieved out dockage.	______	______
11. Weighed dockage (container weight, empty, recorded).	______	______
12. Calculated percentage of sample that is dockage.	______	______
13. Weighed a dockage free sample.	______	______
14. Determined number of broken, shrunken kernels in the sample.	______	______
15. Calculated percentage of damaged kernels.	______	______
16. Consulted a chart to determine grade of sample.	______	______

The student:	YES	NO
17. Recorded the grade on the assignment sheet.		
18. Used proper tools correctly.		
19. Performed steps in a timely manner.		
20. Practiced safety rules through procedure.		
21. Provided satisfactory responses to questions asked.		
22. Put away tools and cleaned work area.		

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Gathered Sample	4	3	2	1
Determined Grade	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

PRACTICAL TEST 3

GRAIN PRODUCTS

VIII

OBJECTIVE 20c

Process wheat into flour.

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	YES	NO
1. Read manufacturer's instructions for operating the grinder.	_____	_____
2. Weighed the bowl and recorded the weight or set the scale to the weight of the bowl.	_____	_____
3. Tightly secured the grinder to a bench or table.	_____	_____
4. Placed grain where it can be easily reached and bowl where it will receive the flour from the grinder.	_____	_____
5. Placed flour in receiving hopper according to manufacturer's directions.	_____	_____
6. Turned crank slowly, with a steady pressure.	_____	_____
7. Continued grinding until 5 pounds of whole-wheat flour were obtained.	_____	_____
8. Used proper tools correctly.	_____	_____
9. Performed steps in a timely manner.	_____	_____
10. Practiced safety rules through procedure.	_____	_____
11. Provided satisfactory responses to questions asked.	_____	_____
12. Put away tools and cleaned work area.	_____	_____

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:	4	3	2	1
Smooth, even flour				

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

WRITTEN TEST

GRAIN PRODUCTS VIII

NAME ______________________________ SCORE ________

OBJECTIVE 1

Match terms associated with grain products to their correct definitions. Write the correct letters in the blanks.

____ 1. Any insect, disease, or plant that competes with humans or domestic animals for food or water

____ 2. Any plant growing where it is not wanted

____ 3. Microscopic, one-celled organisms

____ 4. The seed of grasses cultivated for human or animal food

____ 5. Microscopic infective agents that are capable of growth only in living cells; responsible for diseases in plants and animals

____ 6. A highly complex series of amino acids occurring in all animal and vegetable matter, essential for the growth and for the life of animals and people; needed for muscles and tissues

____ 7. Any compound dry or wet that is found to kill pests

____ 8. A combination of starches and sugars; essential for energy

____ 9. Artificial movement of air currents used to cool, but not to dry, grain in storage

a. Nitrogen

b. Cereal grain

c. Pesticide

d. Crabgrass

e. Pest

f. Weed

g. Bacteria

h. Carbohydrates

i. Virus

j. Ventilation

k. Gluten

l. Centrifuge

m. Herbicide

n. Fumigation

o. Aeration

p. Kernel

q. Organic

r. Protein

s. Seed

t. Abrasive

u. Vitamins

___10. Complex organic substances found in various foods and vegetables; essential for the normal functioning of the body

___11. A tough, sticky mixture of plant proteins obtained by washing out the starch from wheat or other cereal flour and used as adhesive and thickener

___12. A rotary machine for the separation of substances having different weights by spinning them away from the center

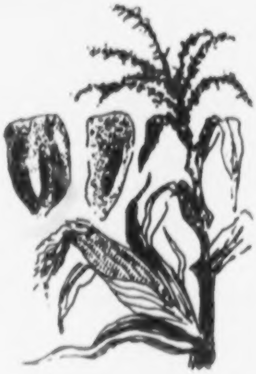
___13. A process of disinfecting using gas-like substances

___14. Capable of growing and developing

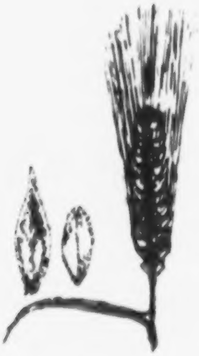
___15. Material designed to wear away a surface by the use of friction

OBJECTIVE 2

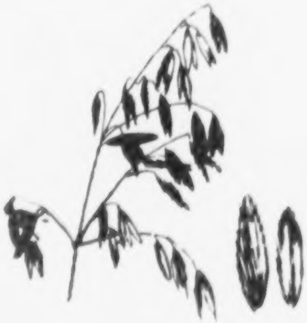
Label types of grains. Write the correct grains in the blanks under each picture.



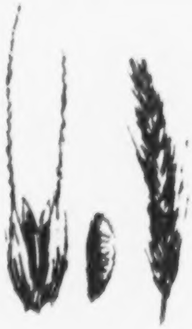
1.________________________



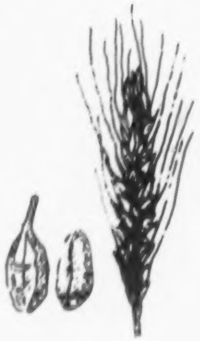
2. ________________________

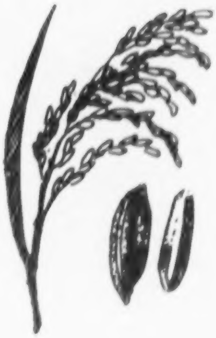


3.________________________



4. ________________________





5. ____________________　　6. ____________________

OBJECTIVE 3

State the function of parts of the grain.

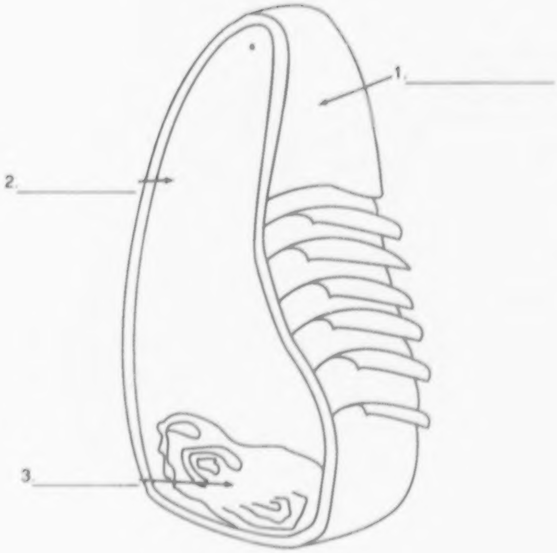
1. Endosperm—____________________

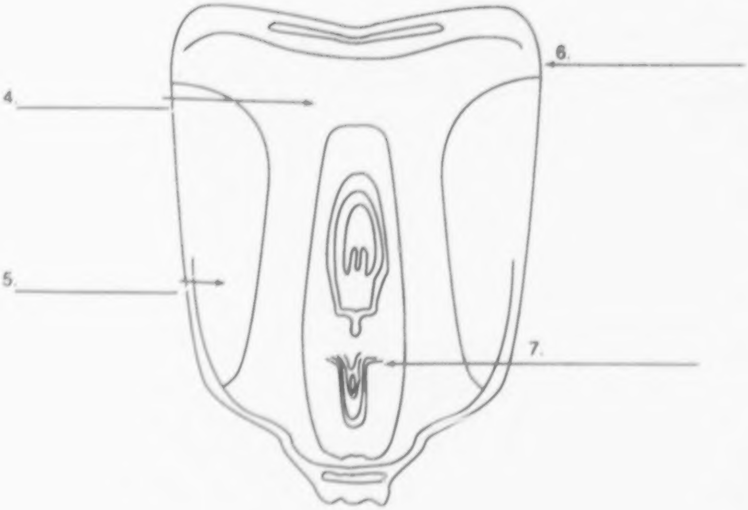
2. Germ—____________________

3. Hull or bran—____________________

405

OBJECTIVE 4 **Label parts of grain.**





OBJECTIVE 5

Distinguish among characteristics of common grains used for human consumption. Write the name of the correct grain or grains in the blank before each characteristic. Write "All" in the blank if the characteristic is true of all the grains.

Oats
Barley
Wheat
Rye
Rice
Corn

__________ 1. Seed eaten intact with only hull, bran, germ removed; no grinding/flattening necessary

__________ 2. Cereal grains

__________ 3. Processed to make sweeteners

__________ 4. Yields a kernel that may be eaten unmilled

__________ 5. Chief breadstuff of temperate climates

__________ 6. Its pearls used in making soup

__________ 7. Chief foodstuff of Asian countries

__________ 8. Usually sold as a rolled cereal

__________ 9. Seed is eaten intact with only hull, bran and germ removed

__________ 10. Grown chiefly for animal feed

OBJECTIVE 6

Match types of wheat flour to their descriptions. Write the correct letters in the blanks.

____ 1. Flour to which a leavening agent and salt have been added

____ 2. Flour made from hard red wheat; high in protein; used for pasta

____ 3. Milled wheat in which the natural parts of the wheat grain remain unaltered

____ 4. White flour to which the B vitamins thiamin, riboflavin and niacin and the mineral iron have been added; calcium and vitamin D may also be added

____ 5. Milled and sifted wheat; may be bleached or unbleached

a. Durum flour
b. Soft flour
c. Whole wheat flour
d. Cracked wheat
e. Enriched flour
f. Bleached flour
g. Self-rising flour
h. Unbleached flour
i. White flour

OBJECTIVE 7

Name types of flour according to their uses. Write the correct names in the blanks.

__________1. Milled from hard wheat and fairly high in protein; used mainly by bakeries.

__________2. Milled from soft wheats and fairly low in protein content; soft and silky; used for baked products.

__________3. A blend of hard and soft wheats which contain a moderate amount of gluten (protein); used for making breads, pastries, cookies and cakes.

OBJECTIVE 8

Match types of milling processes to their descriptions. Write the correct letters in the blanks.

____ 1. Endosperm is broken then pressed flat; used as cooked cereal and cookie-making products

____ 2. Hull is removed, bran is split open but granules are larger than required for meal or flour

____ 3. Grain is reduced to powder or to small particles by friction; rollers work against one another with grain between them

____ 4. Finer materials are sorted from coarser materials using meshes of various sizes

a. Hulled

b. Ground

c. Groats

d. Cracked

e. Rolled

f. Abraded

g. Sieved

OBJECTIVE 9

Identify grains according to their standard milling processes. Write the correct grains in the blanks.

__________1. May be eaten as whole kernels without milling.

__________2. Milled by placing grains under a series of rollers set closer and closer together with a sieving action between each rolling operation.

__________3. Wet-milled in a series of operations that yields sweeteners dextrin and dextrose.

__________4. Milled by abrasive discs or moving rubber belts that remove only bran and germ.

OBJECTIVE 10

Select from a list true statements about the essential nutrients found in grains. Write an "X" in the blank before each true statement.

____ 1. Vitamins contribute to excessive weight gain.

____ 2. B vitamins are essential for healthy nerves.

____ 3. Vitamin C promotes healthy hair.

____ 4. The vitamin for healthy bones and teeth is Vitamin A.

____ 5. Whole grains are rich in vitamins, minerals, proteins, and carbohydrates.

____ 6. Most of the vitamins, minerals, and the protein are found in the germ and the bran of the grain.

____ 7. In "natural" grain products, the milling process retains the vitamins and minerals so the products are not enriched.

____ 8. Some grains are high in fats that help the body create energy.

OBJECTIVE 11

List products made from common grains for human consumption. List three products for each grain in the blanks below.

Wheat— ______________________________

____

____

____

Rice— ______________________________

____

____

____

Corn— ______________________________

____

____

____

Barley— ____________________

____

____

____

Oats— ____________________

____

____

____

OBJECTIVE 12 **List criteria for high grade wheat.**

____

____

____

____

OBJECTIVE 13 **Select from a list true statements about requirements for grain storage.** Write an "X" in the blank before each true statement.

____ 1. Insects thrive in moist stored grain when the temperature is above 90° F (32° C).

____ 2. Commercial storage requires a fixed rate be paid per day.

____ 3. The aeration of grain discourages insects.

____ 4. Moisture can generally be held to an isolated area.

____ 5. Mold damage is controlled by aeration.

____ 6. An airtight storage facility keeps out mold.

____ 7. Grain is dead seed and so will not sprout when moisture and temperatures are favorable.

____ 8. Once grain is stored, it must maintained and cared for.

____ 9. Even though temperature is controlled, insects may find "pockets" where they may survive.

____ 10. Sprouting of stored wheat is only a problem in the fall.

OBJECTIVE 14 **Discuss the use of chemical controls.**

OBJECTIVE 15 **Complete statements concerning U.S. grain markets.** Circle the answers that BEST complete the statements.

1. The biggest grain export is ______.
   a. wheat
   b. corn
   c. oats
   d. rice
2. Marketing of grain depends on ______.
   a. the highest bidder
   b. the European Common Market
   c. supply and demand
   d. the value of the US dollar abroad
3. The markets that consume most of the U.S. rice, barley, rye, and oat production are in ______.
   a. Europe
   b. Asia
   c. U.S.
   d. Russia

4. Corn is exported to the Soviet Union to be used PRIMARILY for ____________.

   a. corn bread

   b. corn meal

   c. cattle feed

   d. whiskey

5. The country that is NOT a member of the European Common Market is ____________.

   a. Italy

   b. Russia

   c. France

   d. The Netherlands

6. Storage decisions are governed PRIMARILY by ____________.

   a. supply and demand

   b. U.S. government regulations

   c. profits

7. Most of the wheat exported goes to ____________.

   a. China

   b. Egypt

   c. Japan

   d. Europe

OBJECTIVE 16 **List nonfood uses for grain products.** Write five examples in the blanks below.

____

____

____

____

____

NOTICE The following assignment sheets and job sheets are not part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 17 **Identify common grains.** SCORE ________

OBJECTIVE 18 **Identify corn sweeteners used in snack foods.** SCORE ________

OBJECTIVE 19 **Solve a dockage problem.** SCORE ________

OBJECTIVE 20 **Demonstrate the ability to**

a. **Clean a sample of grain.** RATING _______

b. **Grade a sample of wheat.** RATING _______

c. **Process wheat into flour.** RATING _______

WRITTEN TEST ANSWERS

GRAIN PRODUCTS

VIII

OBJECTIVE 1

1. e
2. f
3. g
4. b
5. i
6. r
7. c
8. h
9. o
10. u
11. k
12. l
13. n
14. q
15. t

OBJECTIVE 2

1. Corn
2. Barley
3. Oats
4. Rye
5. Wheat
6. Rice

OBJECTIVE 3

1. Food storage part of the seed containing protein and starch
2. The reproductive part of the seed, contains vitamins and minerals
3. Hard, protective covering on a grain seed; contains vitamins and minerals

OBJECTIVE 4

Wheat

1. Bran
2. Endosperm
3. Germ

Corn

1. Soft starch
2. Hard starch
3. Hull
4. Germ

OBJECTIVE 5

1. Rice
2. All
3. Corn
4. Corn
5. Wheat
6. Barley
7. Rice
8. Oats
9. Rice
10. Oats, rye

OBJECTIVE 6

1. g
2. a
3. c
4. e
5. i

OBJECTIVE 7

1. Bread flour
2. Cake flour
3. All-purpose flour

OBJECTIVE 8

1. e
2. d
3. b
4. g

OBJECTIVE 9

1. Corn
2. Wheat
3. Corn
4. Rice

OBJECTIVE 10

2, 5, 6, 8

OBJECTIVE 11

Answer may include any three products listed below for each grain.

- WHEAT
  - Spaghetti
  - Noodles
  - Macaroni
  - Bread products
  - Bulgur (cracked wheat)
  - Crackers
  - Pastries
  - Breakfast
- RICE
  - Cereal
  - Cakes
  - Vinegar
  - Flour(for people with wheat allergies)
  - Sweetener
  - "As is" with hull/bran, and germ removed
- CORN
  - Chips
  - Tortillas
  - Muffins (corn meal)
  - Sweeteners: syrup, dextrose, dextrin
  - Cornstarch
  - Breakfast cereals
- BARLEY
  - Malt flavorings (Crackers, cookies, etc., malted mile)
  - Pearls (soup) (whole seeds)
  - Flour (baby foods)

- OATS
  - Rolled (cereal)
  - Cookies
  - Filler
  - Bran

OBJECTIVE 12

Answer should include the following:

- Has a god natural odor
- Is dry and clean, plump and heavy
- Is not mixed with wheat of another class
- Does not contain damaged or shrunken grains
- Is free of smut and injurious insects

OBJECTIVE 13

2, 5, 8, 9, 11, 12

OBJECTIVE 14

Answers should include at least three of the following four major points:

- A growing world population puts severe strain on the food supply and agricultural land must be used efficiently.
- Because the insect population is so large, the effective, fast methods of control offered by chemicals are essential.
- Without chemical controls insects, weeds, and plant diseases would destroy both the quantity and quality of the food supply.
- Although alternatives are available, they are not as effective nor as fast, especially in the control of disease that, now, is best controlled by chemically treating the seed.

OBJECTIVE 15

1. a
2. c
3. c
4. c
5. b
6. a
7. b

OBJECTIVE 16	Answer should include the following: • starches for adhesive • starches for biodegradable plastic fiber • gasohol • medicine • garden and landscaping
OBJECTIVE 17	Refer to Answers to Assignment Sheet 1.
OBJECTIVE 18	Refer to Answers to Assignment Sheet 2.
OBJECTIVE 19	Refer to Answers to Assignment Sheet 3.
OBJECTIVE 20	Refer to Practical Test Ratings for Job Sheets 1 through 3

OBJECTIVE SHEET

PACKAGING AGRICULTURAL PRODUCTS

IX

INTRODUCTION

Modern food demands have made packaging a competitive, complex science involving primary and secondary containers. Some agricultural products are supplied by nature with a primary container such as eggs, potatoes, nuts, onions, and bananas. Many others need both processing and packaging for transporting and marketing.

UNIT OBJECTIVE

After completing this unit, the student should know the types of packaging and how they are used, be able to determine the cost of packaging, know the difference between biodegradable and recycled packaging, be able to identify wrappings, canning materials, sealing methods, know the parts of labels, the order and units in which items appear on labels, and the effect of packaging on shelf life. The student should be able to interpret a label and design a package for an agricultural product. The student will demonstrate these competencies by completing the assignments sheets and written test with a minimum of 85 percent accuracy.

UNIT OBJECTIVES

1. Match terms associated with packaging agricultural products to their correct definitions.
2. List general requirements for food packaging.
3. Select from a list true statements about types of packaging.
4. Define biodegradable, degradable, and recyclable materials.
5. Select from lists statements about wrapping materials.
6. List sealing methods used in packaging.
7. Define terms associated with dating on food labels.
8. List in order the information to be printed on an approved label.
9. Select from a list true statements about bar codes.
10. Select from a list factors affecting shelf life.
11. Interpret a label. (Assignment Sheet 1)
12. Determine packaging, dating, and sealing methods. (Assignment Sheet 2)

13. Discuss packaging practices. (Assignment Sheet 3)
14. Calculate the cost of packaging. (Assignment Sheet 4)
15. Design a package for an agricultural product. (Assignment Sheet 5)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

- Invite a USDA Extension agent to speak about labeling and packaging materials.

- Contact the manager of the local supermarket and ask for an interview time, either for the class to visit the store or for the manager to visit the class. Use Handout 1 as a starting point for questions and discussion. Have students write out additional questions.

DELIVERY

Objective 1

- Ask students questions to determine what they expect from the package when they order a delivery pizza. Look for answers such as:

  - product will be intact
  - product will be undamaged
  - package may be reclosed
  - package may be easily opened
  - product will retain heat for a reasonable time
  - package will hold product so it will not slide when carried
  - package does not add flavor

  - package does not cause product to lose flavor
  - package is easily disposed of

- Arrive at some terms/types of packaging using comments from students.

- Assign students to bring sample packages to class, including boxes, bags, jars, cans, jugs, retortable bags, edible packaging, etc. Look for tamper-resistant and tamper-proof containers. Keep these items to be used later.

Objectives 2 and 3

- Use the Information Sheet to discuss types of packaging.

- Let students examine the packages that were brought to class and encourage discussion as to identifying characteristics and types of packaging.

Objective 4

- Use the Information Sheet to lead a discussion on biodegradable, degradable and recyclable packaging.

- Show videotape *Degradable Plastics and the Environment.*

- Discuss recycling opportunities in your community.

- Create an aluminum can recycling project to raise money for a trip or other activity.

- Have students read articles on landfill, and garbage disposal problems, and have a group discussion on waste and methods of controlling disposal.

Objective 5

- Use the Information Sheet to stimulate discussion about wrapping materials.

- Use Supplement 2 to discuss factors to consider in package design.

Objective 6

- Use the Information Sheet to introduce sealing methods.

- Have students examine the array of packaging they have brought to class to increase awareness of the great variety of sealing methods.

- Have students complete Activity Sheet 1.

Objectives 7 and 8

- Use the Information Sheet to discuss labeling.
- Ask students to bring labels printed with "sell by" and "best if used by" printed with dates.
- Be alert to media coverage of labeling regulations. There is much discussion at both state and federal levels of government regarding this matter.

Objective 9

- Use the Information Sheet to discuss bar codes.
- Write 100001001 on the chalkboard. Explain that this arrangement of "1's" and "0's" represents "A" to a specially designed computer using "code three of nine" pattern.
- Tell students that each car of the Tokyo Disneyland's "Space Mountain" ride has an arrangement of "1's" and "0's" on its right side. This code is read, fed into a computer, and reveals to the attendant where each car is at all times on the ride.
- Question the students to find out whether they are familiar with binary numbers. If they are not tell them that binary numbers have been devised to speed up computers and that only two symbols for numbers are used, "1" and "0." From this system of numeration the punch card and the binary bit have been invented. Bar codes are a result of this discovery.
- Tell students that in some marathon races officials issue a bar code to each competitor which is printed on the bib that each competitor wears. Officials using hand-held scanners keep track of each competitor to help eliminate cheating.

- New uses for bar codes are being discovered very rapidly.
  - Japanese patrons of health clubs have a bar-coded ID bracelet that allows them to use workout rooms and saunas without needing to carry cash.
  - A bee keeper devised a method of bar-coding bees so that he could study his hive without getting stung.
  - Money transactions, even salary deposits are handled using bar-codes in Japan.

Objective 10

- Use the Information Sheet to discuss factors affecting a product's shelf life after packaging.
- Have students check sample packages for expiration dates.

APPLICATION

Objective 11

- Use Assignment Sheet 1 to help students learn ways to use label information.
- Compare label information on sample labels as a practice for completing the assignment sheet.

Objective 12

- Use Assignment Sheet 2 to teach students to observe packaging and be alert to these criteria.

Objective 13

- Use Assignment Sheet 3 to have students analyze packaging practices and discuss their conclusions and beliefs.

Objective 14

- Use Assignment Sheet 4 to help students understand how costs accumulate and on what factors packaging costs are based.

Objective 15

- Use Assignment Sheet 5 to help students realize the many factors involved in package design and engineering.
- Have students use Supplement 2 to complete the design.

- Stress the factors of evaluation:
  - Decide on a product
  - Determine merchandising requirements
  - Determine consumer acceptability
  - Determine shelf life needs
  - Choose an acceptable container according to material, size, and shape
  - Draw, describe, or make a label that conforms to FDA regulations
  - Draw, describe, or make a package to conform to the choices made for the above product
- Encourage students to share their designs in an oral presentation to the rest of the class.

EVALUATION

Practical Test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Give practical test.
- Reteach and retest as necessary.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.

- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Audiovisual Materials

- *Degradable Plastics and the Environment.* 1/2" VHS, 16:36 min., color, Mobile Corporation 1989. Discusses the problem of waste disposal and the environment; the value of waste disposal plants; how biodegradable products degrade and fail to degrade in a waste disposal plant; how designing and building biodegradable or photodegradable products affect product costs; the advantages of recycling as a solution to our disposal problems.

  NOTE: This tape is available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Resource Center, Instructional Media Specialist, Oklahoma Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074 (1-800-522-5810 ext. 164). Out-of-State teachers may order it from Mobile Chemical Company, Customer Relations, Stone Mountain, Georgia, 1-800-476-4300.

- *Nutrition Labeling: What's in it for You?* Slide set, 11 min., color, 71 slides, with cassette and script. Cornell University, 1977. How nutrition label information can be applied in a variety of food choice and diet planning situations. Cartoon format. Available for rent from Instructional Media Services, Washington State University, Pullman, Washington 99164-5602, phone (509)335-4535, or (509)335-5618. Order by title.

Publications

- Any guide to vitamins and minerals.
- *Degradable Plastics and the Environment*, Mobil Oil Corporation, available on loan from Oklahoma Department of Vocational and Technical Education with the videotape listed above.
- Recent articles on nonbiodegradable, biodegradable, degradable, and recycling issues or projects.

UNIT REFERENCES

- Oklahoma Board of Agriculture, "Open Dating Regulation," Authority: 20.S. Supp. 1987, Section 5-61 et seq.

- *Packaging Encyclopedia*, Reed Publishing, Newton, Massachusetts, 1987.

- Potter, Norman N., *Food Science*, 4th ed., Van Nostrand Reinhold, New York, 1986.

- Personal Interviews with Mr. Gary Crane, Owner/President/ Manager, Ralph's Packing, Perkins Oklahoma; Dr. Abe Wahem, Professor, Oklahoma State University, Stillwater, Oklahoma; Mr. Dane Warnock, Sales Manager, Farm Fresh, Ponca City, Oklahoma; Mr. Randy Weddle, Production Planner, Farm Fresh, Chandler, Oklahoma.

- Telephone Interviews with McDonald's Corporation, Customer Relations, Atlanta, Georgia and Mobile Chemical Company, Stone Mountain, Georgia.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Science 466	Identifies	Definitions	
	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 2	Language Arts 052	Composes/ Edits	Drafts/ written	
	Free Enterprise 115	Describes/ Explains	Needs/wants	Good/services
	Science 114	Describes/ Explains	Chemical reaction	
OBJECTIVE 3	Language Arts 139	Comprehends	Information-written	Context
	Science 474	Identifies	Matter properties	Physical
	Science 476	Identifies	Matter	Uses
OBJECTIVE 4	Science 114	Describes/ Explains	Chemical reaction	
	Science 163	Describes/ Explains	Ecology	Decomposers
	Language Arts 013	Applies/Uses	Definitions	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 5	Language 139	Comprehends	Information-written	Context
	Science 474	Identifies	Matter properties	Physical
	Science 476	Identifies	Matter	Uses
	Language Arts 038	Collects/ Organizes	Information-written	
OBJECTIVE 6	Science 337	Describes/ Explains	Matter	
OBJECTIVE 7	Language Arts 038	Collects/ Organizes	Information-written	
OBJECTIVE 8	Language Arts 038	Collects/ Organizes	Information-written	
	Language Arts 147	Comprehends	Information-written	Sequence
OBJECTIVE 9	Language 139	Comprehends	Information-written	Context
	Language Arts 191	Evaluates	Information-written	Validity
OBJECTIVE 10	Language Arts 139	Comprehends	Information-written	Context
	Language Arts 191	Evaluates	Information-written	Validity

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 11	Mathematics 015	Calculates/ Evaluation	Percent markup/discount	In/decrease,
	Language Arts 186	Evaluates	Information-written	Propaganda techniques
	Mathematics 127	Converts	World problems	Mathematical expressions
	Mathematics 034	Computes	Addition	Whole numbers
	Mathematics 047	Computes	Division	Whole numbers
	Mathematics 073	Computes	Multiplication	Whole numbers
	Mathematics 092	Computes	Subtraction	Whole numbers
	Mathematics 229	Solve Problems	Generate conclusions	Deductive reasoning
OBJECTIVE 12	Science 342	Describes/	Matter	Physical properties
	Science 470	Identifies	Food groups	
	Science 345	Describes/ Explains	Matter	Uses
	Science 045	Applies/Uses	Scientific methods	Analysis/ quantitative
	Science 046	Applies/Uses	Scientific methods	Data gathering
	Language Arts 013	Applies/Uses	Definitions	
	Language Arts 035	Attends	Directions/task	
	Language Arts 043	Collects/ Organizes	Information-oral/written	Observations
	Language Arts 087	Composes/ Edits	Reports/essays	

	SKILL AREA/ CODE	VERB	LINK A	LINK B
	Science 004	Analyzes/ Evaluates	Chemicals in society	Food additives
OBJECTIVE 13	Language Arts 088	Composes/ Edits	Reports/essays opinions	Editorials/
	Language Arts 043	Collects/ Organizes	Information-oral/written	Observations
	Language Arts 247	Infers/Predicts	Information-written	
	Science 035	Analyzes/ Evaluates	Science technology	Products
	Science 032	Analyzes/ Evaluates	Science technology	Implications/ economic
	Language 159	Describes/ Explains	Perceptual effects	
OBJECTIVE 14	Free Enterprise 118	Identifies	Cost factor	
	Mathematics 026	Computes	Addition	Decimals
	Language Arts 065	Computes	Multiplication	Decimals
	Language Arts 127	Computes	Work problems	Mathematical expressions
OBJECTIVE 15	Language Arts 227	Solves Problems	Generate conclusions	Deductive reasoning
	Language Arts 035	Attends	Directions/task	
	Language Arts 013	Applies/Uses	Definitions	
	Language Arts 071	Composes/ Edits	Oral presentation	
	Language Arts 134	Comprehends	Information-written	Cause/effect relationships

SKILL AREA/ CODE	VERB	LINK A	LINK B
Language Arts 164	Describes/ Explains	Perceptual effects	Propaganda techniques
Language Arts 231	Identifies	Purpose/ strategy	
Science 342	Describes/ Explains	Matter	Properties
Science 343	Describes/ Explains	Matter	Structure
Science 345	Describes/ Explains	Matter	Uses
Language Arts 264	Presents	Informal speech	
Language Arts 278	Uses	Text resources	

HANDOUT 1	PACKAGING AGRICULTURAL PRODUCTS	IX

Suggested discussion questions for a visiting supermarket manager

1. In your opinion, what is the most satisfactorily packaged products in your store? Please explain.
2. What changes in packaging have taken place during your years as a supermarket manager or worker?
3. What is the newest "convenience" entree that your store stocks? Please describe its packaging.
4. Does the firm responsible for the dated products on your shelves remove them it they are unsold?
5. What are the costs of vandalism, that is, people opening packages, breaking bottles, and stealing items?
6. What can consumers do the help keep costs of the supermarket more reasonable?

PACKAGING AGRICULTURAL PRODUCTS

OBJECTIVE 1

Match terms associated with packaging agricultural products to their correct definitions.

- **FDA**—Food and Drug Administration
- **USDA**—United States Department of Agriculture
- **Package**—Any container or wrapping in which food is enclosed for use, delivery, or display of that product to the purchaser
- **Label**—Any display of written, printed, or graphic matter on the immediate container of any customer commodity
- **Biodegradable**—Capable of decaying and being absorbed by the environment over time

  EXAMPLE: Paper and kitchen scraps are biodegradable compared to aluminum cans and many plastics which do not decay but remain permanently intact.

- **Recyclable**—Capable of being reused through breaking up, cleaning, and reprocessing the raw materials
- **Kraft paper**—Brown, unbleached paper used for strong grocery bags and wrapping
- **Primary container**—Container that comes in direct contact with the food

  EXAMPLE: A can or jar

- **Secondary container**—Container that does not come in direct contact with the food

  EXAMPLE: The outer box or wrapper

- **Shelf life**—Length of time a product may be expected to remain in satisfactory condition on a shelf

  NOTE: Shelf life is the time within which a product will not be damaged by light, moisture, normal gases, or bacteria in the product.

  EXAMPLE: Normal gases are oxygen and carbon dioxide

- **Cellophane**—A transparent paper-like product made from processed wood fibers
- **Laminated**—Formed of or set into thin layers of different materials that are fused together
- **Co-extrusion**—Process in which two or more films of plastic, foil, or paper may be fed through a machine to form a multilayered material suitable for packaging
- **Hermetic**—Condition in which a package is fully protected against dirt, dust, bacteria, fungus, insects, and other damaging elements
- **Poly**—Greek prefix meaning "many"
- **Aseptic**—Free from disease-producing bacteria and not likely to spoil
- **Tamper-evident**—Package on which the seal or wrapper is visibly, immediately damaged on opening

  NOTE: The consumer will know immediately that someone has opened it.
- **Tamper-resistant**—Packaging designed to make illegal or harmful entry into the product as difficult as possible

  NOTE: The product has a special lid or seal that is difficult to break.
- **Multilayered**—Packaging material consisting of two or more films or layers of different materials

OBJECTIVE 2

List general requirements for food packaging.
(Activity Sheet 1)

Containers must

- Be nontoxic and cause no chemical or other reactions with food product
- Offer protection against germs, dirt, insects, rodents
- Keep moisture in or out as product requires

  EXAMPLE: Moist foods (such as mustard or mayonnaise) must retain moisture; foods damaged by moisture must be kept dry (potato chips or crackers).

- Keep gas (carbon dioxide, oxygen) in or out as required

  EXAMPLE: Packaged biscuits and oven-ready dough produce small amounts of carbon dioxide that must be allowed to leak from the package.

- Be tamper-resistant or tamper-evident

  NOTE: All packagers these days must consider tamper-resistant and tamper-evident packaging. Consumers must be protected from the harm that tampering may do. Laws have been passed making the packager responsible for providing as much protection as is humanly possible. Baby food jars have a vacuum sealed lid with a button that pops up when opened. This device was invented to replace a simple screw top lid when many jars were found opened, taste-tested, then returned to the store shelves.

- Be easy to open

  NOTE: Easy-opening devices include pull-tabs on cans and twist-off bottle caps. Twist-off caps have to be engineered for easy-opening and be able to resist internal pressure from carbonated liquids that can cause the bottles to burst. The result is the characteristic fluted-edged cap.

- Have pouring spouts for pouring contents
- Have reseal features if contents are to be stored
- Be impact resistant

  NOTE: Impact resistance deals with product stress/abuse during transport/storage/display.

- Be easily disposed of
- Be able to carry printed information well
- Be reasonably priced
- Be adaptable for special features

  EXAMPLES: Fat protection keeps butter (but not necessarily moisture) from passing through the wrapper.

- Protect the product from light damage

  NOTE: They may be transparent to allow customers to see packaged product.

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OBJECTIVE 3 **Select from a list true statements about types of packaging.** (Supplement 1)

- All primary containers are made of materials strictly monitored by the government.

Cans

- Made of aluminum or steel.
- Steel cans may be tin-coated outside for rust-proofing (because the steel rusts easily) and enamel-coated inside to protect the product from rusting, pitting, or chemical reaction with the steel.

  NOTE: Advances are continually being made in the engineering of cans. U.S. Army Natick Laboratories, Continental Can Co., and Reynolds Metals Co. did most of the development work.

- May be hermetically sealed for total product protection.
- Aluminum is a light-weight material that is recyclable and allows for easy-open tabs such as those found on soda cans. The tab easily pulls away from the soft metal.

  NOTE: Softness and thinness of aluminum has not made it a satisfactory substitute for the widely used, steel-based can. Beverages packaged in aluminum cans are processed with nitrogen to keep the sides rigid during transport and storage. When the tab is pulled open, the gas is released and the sides crush for easy recycling. Some cans have a special coating on the inside to protect the beverage from absorbing a metallic taste.

Jars, jugs, and bottles

- May be made of glass or multilayered plastic.

  NOTE: Weight and breakage problems of glass jars have made substitute plastic jars popular. Researchers continue to find methods to develop lighter, break-resistent glass. Its advantage over plastic is that it is recyclable.

- May be hermetically sealed so long as lids are tightly sealed.
- Glass does not cause a chemical reaction with the contents.
- Glass may be colored to protect products from damage due to light exposure.

Boxes

NOTE: Ninety-one percent of the boxes made by the U.S. paper industry are single-wall containers used for shipping. Single-wall boxes are made from linerboard and a fluted material. Linerboard is glued to both sides of the fluted material. The entire board is cored (marked with grooves) to be folded to the appropriate size. These boxes are strong and travel and stack well.

- May be constructed of paper, fiber or wood.
- Must be specially processed when used as a primary container.

  NOTE: Boxes are more often used as secondary containers.

- Must exhibit most of the features listed under general requirements.
- Are generally fully rigid.

Bags

- Made of plastics or of paper to which foil and special plastics have been laminated. The purpose of the bag dictates what plastic film is used and whether foil is also used.
- May be required simply to protect snacks from odors and various spoilages, and may also be required to resist temperatures below freezing and above boiling.
- May be made to dispense one serving of a condiment, such as catsup or salt, or dispense an entire meal.

Retortable Pouches

EXAMPLE: U.S. military rations

- Are flexible.
- Are heat sealable.
- Are relatively flat containers that stack, store, and travel more economically.

- Are capable of withstanding high temperatures.

  NOTE: Food can be sterilized right in the pouch. This sometimes contributes years to the shelf life of the product. Sterilization takes place in a special machine called a retort.

- Are made of 3-ply laminated material made from polyester, aluminum foil, and polypropylene.

- Can be processed in a shorter time than jars or cans.

- Can provide better nutritional quality than jarred or canned products.

Trays

- May be made of paperboard, plastic, or aluminum.

- Answer the demand for convenient, easily disposed of containers that can be stored frozen, transferred to a conventional or microwave oven for cooking, used as the serving dish, then thrown away. They require a wrapping material either attached as a lid during manufacturing or added as the product is processed.

OBJECTIVE 4 **Define biodegradable, degradable, and recyclable materials.**

Many modern packaging materials and methods are entirely dependent on the mixing and fusing of chemical elements. These chemical products remain intact, as in their newly-made state, for many years, sometimes permanently, and contribute to growing environmental dangers and garbage disposal problems.

Packages need to be burned, crushed, or ground up for disposal. Some plastic jugs are going out of use because they are not recyclable or biodegradable.

Many communities now have a recycling plant and ask residents to separate their trash into recyclable and non-recyclable containers. Interest in biodegradable products and the recycling of materials has become strong enough that packagers are beginning to provide alternatives to nonbiodegradable products.

- Biodegradable materials are those that can be returned to the earth where microscopic organisms in the soil break down the materials and convert them to soil.

Packaging products made from natural fibers such as wood (cellulose), cotton or silk fiber, and other plant materials are biodegradable. They are used in paper, cellophane and untreated boxes. However, the modern consumer demands that packaged food products be convenient. This demand often requires some additional chemical treatment making biodegradable packaging impossible. Therefore, for the time being, recycling and degradability are more common methods of coping with the environmental problems.

- **Degradable materials** are those which may be absorbed by the atmosphere but are not returned to the earth. Microscopic organisms cannot break down these materials. Some plastic bags and disposable diapers are photodegradable, that is, they degrade in the presence of sunlight.
- **Recyclable materials** are those which can be put to another use after certain processes change and reconstruct them. New technology is becoming available that allows for the cleaning, breaking up, and reprocessing of certain materials that, until recently, added to the pollution of the earth.

  EXAMPLE: Glass, aluminum, and paper products can be easily recycled.

OBJECTIVE 5

Select from lists statements about wrapping materials. (Supplement 2)

Package wrappings made from natural wood pulp are constantly treated and improved to remain competitive with plastic wrap materials. Package appearance is important because the consumer must be persuaded to buy, use, and buy again.

Paper

NOTE: Paper is a natural product made from cellulose found in trees, is biodegradable, and is treated with additives for specific packaging needs.

- Paper may be bleached, treated, or laminated to:
  - Improve its protective qualities.
  - Increase its flexibility.
  - Improve its resistance to tearing.
  - Increase its burst strength.
  - Improve its ability to remain intact when wet.
  - Improve grease resistance to keep fat from leaking out.
  - Increase the sealing choices.

- Improve package acceptability to print.
- Increase absorbency if paper is processed into trays to hold uncooked meat or poultry.

- Kraft paper is unbleached, strong; used mainly for bags, wrapping paper, and secondary containers.

- Glassine is made of wood pulp fibers, is strong and semitransparent.

  EXAMPLE: Crisp, transparent liners in cookie packages.

- Paper used in food packaging is rigidly controlled by the FDA.

  EXAMPLE: Milk cartons must be made from sanitary, unreprocessed wood pulp and must pass rigid tests for bacteria content.

Plastics

- Co-extrusion is a process in which two or more layers of different types of plastic film are forced out of a special machine. The layers are rolled together to form a more useful multilayered film.

  NOTE: Multilayering increases the number of uses for both paper and plastic film wrappings. Cellophane, polyester, and nylon are only three materials of dozens used for this process.

- Plastic and film wrappings are made chemically from various combinations of resins and other materials. New techniques, new materials, and new packages are being invented and introduced to the customer.

- Polycarbonate film meets FDA standards for use with a wide variety of food packages, including meat. It provides packagers with a product that has a gradual softening range, offering flexibility.

  - Requires less expensive machinery in its processing.
  - Remains clear in a wide temperature range.
  - Provides hot-fill strength for boil-in-the bag items.
  - Resists pinholing that gradually robs foods of necessary moisture .
  - Is fungus resistant.

  NOTE: Polycarbonate is one of many films. When a wrapping film is needed, all properties of the proposed film must be considered. Much engineering and research has been devoted to the various films, their composition, and use. It comes in many widths and thicknesses. The film does not need expensive heat-intensive treatment, and will perform well in gradual temperature changes.

Aluminum foil

- Is the only readily available, flexible wrapping that provides a total barrier against light, gas, and moisture transmission.
- Provides a quality image for the product.
- Can be coated, laminated, and decorated in a number of ways.
- Needs protection from rough handling because pin holes develop easily and can cause product deterioration.
- Is abundant.
- Is nontoxic.
- Is recyclable.

Laminated materials

- Paper, plastic materials, and aluminum foils may be laminated to produce flexible packages of all kinds to meet many packaging requirements.

  EXAMPLE: A bag of microwaveable popcorn must have an outside layer that will fold into a pouch, is capable of either itself being grease/gas resistant or laminated to a material that is; must be laminated to a foil or metallized film for even heat distribution; and laminated to an acceptable inner lining. All layers are required to perform without breaking as the corn pops in the microwave. The package must also provide the serving container and then be ready for quick disposal.

Edible coatings

- Space travel has made edible coating necessary in bite-size dessert pieces.

  NOTE: If the dessert pieces were larger than bite-size and not coated, crumbs might break away from the product and fly about in the cabin, contaminating the atmosphere.

- Edible coatings are not a new concept. Frostings or icings on small cakes have been in use for a long time.
- Edible coatings may be made of confectioner's sugar.

OBJECTIVE 6 **List sealing methods used in packaging.** (Activity Sheet 1)

Correct sealing prevents the product from escaping the package and allows no outside substance to enter the package and spoil or contaminate the contents. Consumer convenience is a big factor in determining sealing method.

Bottles and jars are sealed with tops that may

- Screw-on
- Have a lug top fused on in processing

  EXAMPLE: Vitamin bottles with lids that push down and turn

- Close with crimp-on top

  Soft drink bottles

- Be made of either metal, plastic, or a combination and then secured with an attached plastic strip

  EXAMPLE: Gallon milk jugs, vitamin bottles.

- Be taped to show any evidence of tampering
- Have a dispenser top designed to simplify getting the product out of the bottle in controlled amounts

Bags are sealed by

- Sewing or stitching

  EXAMPLE: Pet foods

- Pasting - either single or fold over

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EXAMPLE: Flour, corn meal

- Tin or metal tie

  EXAMPLE: Potatoes, carrots

- Staple

  EXAMPLE: Sausage patty meat bags

- Plastic closure clip (there are several designs)

  EXAMPLE: Reusable sandwich and freezer bags

Boxes may be

- Heat sealed
- Closed with strapping tape
- Glued

OBJECTIVE 7

Define terms associated with dating on food labels.

- **Pack date**—The date the product was processed or packaged.
- **Sell date**—Last date on which a store may sell a product.
- **Freshness date**—The product will not be at the height of freshness after this date.

  EXAMPLE: "Best if used by..."

- **Expiration date**—The last date a product should be used.

OBJECTIVE 8

List in order the information to be printed on an approved label. (Assignment Sheet 1, Supplement 3)

Full nutrition labeling must be used if a food is fortified or enriched (vitamins or minerals added), if a nutritional claim is made, or nutritional information is given on labels or in advertising. An approved label shows the nutrients that a consumer may expect to find in the package on which the label is printed. In addition to the required information, manufacturers and processors often supply information and instructions that are of value to the consumer. Label information is printed in a standardized format, in a specified place on food packages, giving nutritional information established as beneficial to the consumer.

- An approved label has a standardized format. The law requires that these items be included on the label *in this order*:

1. Name of the food
2. Serving size
3. Number of servings per container
4. Number of calories
5. Weight in grams, of protein, carbohydrate, fat, cholesterol, and sodium per serving
6. Percentage of United States Recommended Daily Allowances (U.S. RDA)

   NOTE: U.S. RDAs are printed on a food package so customers can judge the nutritional values such as protein, vitamins, and minerals, and determine how much or how little may be added to their diets by purchasing and eating each serving of the food. These include: Protein, vitamin C, thiamin, riboflavin, niacin, calcium, iron, etc.

7. Other information

   NOTE: Food packages may have additional information indicating what nutritional benefits occur when various food combinations are made. Other information may include: Added minerals and vitamins, if any; notice of added preservatives; processor's main business location; warnings, if necessary.

Some pressurized cans have a warning that the product contains chlorofluorocarbons that can harm public health and the environment by reducing ozone in the upper atmosphere. Some packages may have guarantees printed on the label.

OBJECTIVE 9

Select from a list true statements about bar-codes.

- A bar-code is the label of stripes, some narrow, some wide, printed on a white background and found on almost every package that a consumer purchases.
- Bar-codes feed information to computers that can read that information quickly and accurately by means of a special scanner.

  NOTE: This process is called automatic data entry.
- Bar-codes are made up of binary digits. The narrow bar printed on the label represents a "0" and the wide bar represents a "1." In some codes the white spaces also represent digits. These bars are grouped into patterns that make up all of the numbers and the letters used in the English-language.
- Bar-codes are read by scanning devices that shine a light across the bars. Black bars absorb light. White spaces reflect light back into the scanner.
- The scanners transform the pattern of light and dark into electrical impulses that are measured by a decoder. The decoder translates these impulses into binary numbers that are read by the computer.

  NOTE: The key to the speed and efficiency of bar-coding is the scanning device. Some of these devices are quite simple and relatively inexpensive (below $100). Others are complicated and expensive (over $3,000).
- The technology for bar-coding has been available since the late 1960's, but consumer resistance was so strong that wide acceptance of bar-coding only began in the 1980's.
- Bar-codes are now used to price almost all items that are sold where the transaction is recorded on the computer at a check-out counter.
- Bar-codes keep track of inventory.

  NOTE: Stores need to keep an accurate count of the products they offer for sale. Specially designed packs worn by the inventory takers make the process much faster than it once was when every item had to be individually counted by a person moving through the aisles and storehouses counting by hand. The packs can "read" the bar codes.

OBJECTIVE 10 **Select from a list factors affecting shelf life.**

New methods of packing and filling containers extend the shelf life by preserving quality for a longer period of time. Most manufacturers expect the products to be usable for a time after the shelf date has expired. Careful study by food scientists and packaging experts has determined what kinds of packaging methods and materials provide products with the best protection from spoilage and loss of quality before they reach the consumer.

Dates on packages, especially dairy products, cereals, nuts, and meat products, tell the customer about the expected shelf life of the product, not the last day on which the product may be safely eaten. When the date on the package expires, most manufacturers pull the product from the shelf. Sometimes the items may be sold as stale goods that are quite edible but do not meet the standard of freshness that some consumers desire.

- New processes that contribute significantly to prolonging the shelf life of products are:
    - Aseptic packaging.

      NOTE: Products are packaged aseptically when the *total environment* of the processing is not contaminated with germs or bacteria. New machinery and methods are making this more successful.
    - Laminating of packaging materials to provide more effective barriers against disease, dirt, gas, and odor contaminants.
    - co-extrusion; Co-extruded bottles can provide a shelf life expectation of over a year.
    - Marketing techniques that move the product quickly to the consumer.
    - Gas flushing to rid packages of contaminants.

  NOTE: Sometimes this process is a closely guarded secret.

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PLASTIC PACKAGING

Packaging has become such a complex, multifaceted industry using many highly complicated, chemically created products that a university degree is now offered in Package Engineering.

Plastic resin is the basis of many "poly" materials all of which have a chemical formula of their own.

Resin is a compound formed either by adding molecules of other substances or eliminating water or alcohol from a substance. It item may be used with other products and with various technologies to form many plastic materials.

A few of the plastic materials that may be turned into wrapping film, package trays, cups, and other containers are

- Polycarbonate
- Polyester
- Polyethylene

  NOTE: Polyethylene may be processed into a net suitable as a secondary container. It molds and stretches well to encompass non-conventional shapes.

- PET—an extremely popular, versatile resin made from "the polycondensation product of ethyleneglycol and terephthalic acid by a stretching process called biaxial orientation."

  NOTE:"Biaxial orientation" indicates the product may be stretched in a number of directions, a feature that enhances its flexibility and its versatility.

FACTORS TO CONSIDER IN PACKAGE DESIGN

1. Choose a product
2. Make top priorities
    - Product protection
    - Consumer acceptability

    NOTE: Refer to Objectives 3 and 6 for materials and sealing methods to be used in packaging a product.
3. Discuss material with others to determine options
4. Determine distribution areas

    NOTE: Distribution areas or locations where the product will be sold will often determine packaging requirements.

    EXAMPLE: If the product is to be used in space travel, consideration must be given to its performance in an environment without gravity.
5. Consider package design options:
    - Boxes/pouches
    - Snack products

      EXAMPLE: Crackers and spread in one unit
    - Boil-in-bag
    - Microwaveable packages
    - Bottled products
    - Miscellaneous
6. Determine product weight
7. Determine product appearance
8. Determine physical characteristics

   - Does the product spill?
   - Does the product leak fat?
   - Does the product expel gases?
   - Does the product require carbon dioxide bubbles?

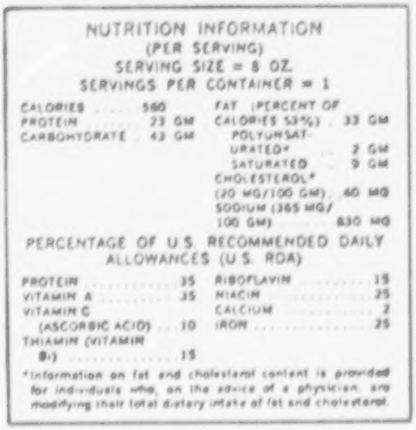
9. Determine length of time on merchant's shelf
10. Determine uses/benefits
11. Determine possible handling abuse in transport and display
12. Determine FDA regulations and label requirements

    NOTE: FDA regulations require some products to be enclosed in order to prevent contact with outer carton walls.

13. Be sure paperboard standards will be met
14. Determine method used to fill package
    - Hand-filling requires wider neck than machine fill
    - Will product settle after filling?
15. Determine closure to be used
    - Will product be consumed entirely once opened?
    - Will product need to be reclosed to preserve freshness?
16. Will there be problems with temperature?
    - From storage methods?
    - From climate?
17. Will the special needs of foreign markets be taken into consideration?

    NOTE: The interpretation of colors, signs, and symbols differ among cultures. A can of tuna featuring the fish diving into the ocean was unacceptable to the Japanese market where a fish with its nose down is considered dead. Cows are considered sacred to some Indians/Malaysians and must not be shown on product labels.

The nutrition label format. Courtesy of U.S. Food and Drug Admin.



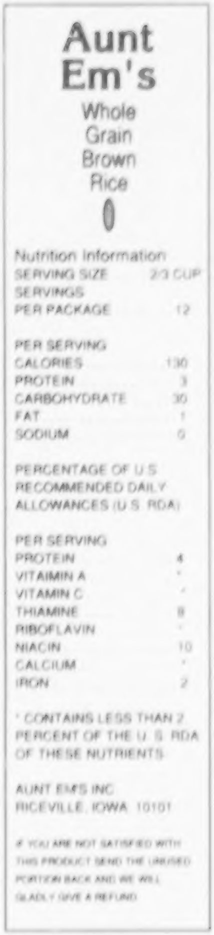
NUTRITION INFORMATION
(PER SERVING)
SERVING SIZE = 8 OZ.
SERVINGS PER CONTAINER = 1

CALORIES	560	FAT (PERCENT OF CALORIES 53%)	33 GM
PROTEIN	23 GM	POLYUNSATURATED*	2 GM
CARBOHYDRATE	43 GM	SATURATED	9 GM
		CHOLESTEROL* (20 MG/100 GM)	40 MG
		SODIUM (365 MG/100 GM)	830 MG

PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCES (U.S. RDA)

PROTEIN	35	RIBOFLAVIN	15
VITAMIN A	35	NIACIN	25
VITAMIN C (ASCORBIC ACID)	10	CALCIUM	2
THIAMIN (VITAMIN B_1)	15	IRON	25

*Information on fat and cholesterol content is provided for individuals who, on the advice of a physician, are modifying their total dietary intake of fat and cholesterol.



Aunt Em's

Whole Grain Brown Rice

Nutrition Information

SERVING SIZE	2/3 CUP
SERVINGS PER PACKAGE	12
PER SERVING	
CALORIES	130
PROTEIN	3
CARBOHYDRATE	30
FAT	1
SODIUM	0

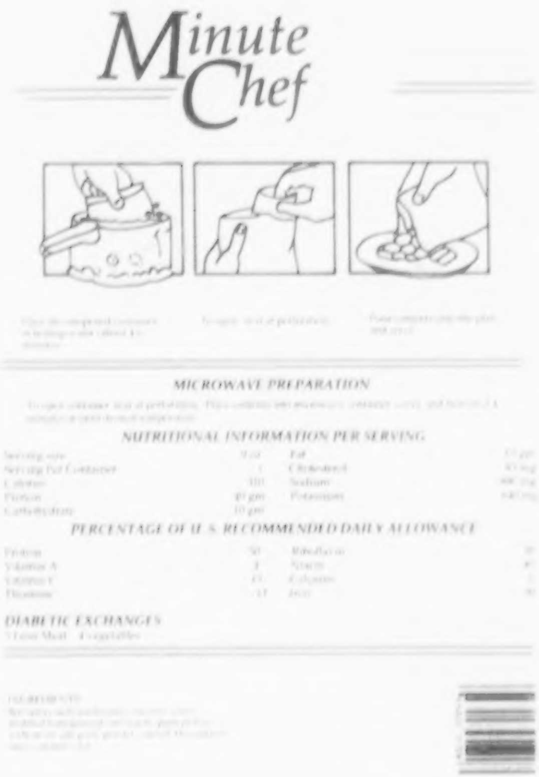
PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCES (U.S. RDA)

PER SERVING	
PROTEIN	4
VITAIMIN A	*
VITAMIN C	*
THIAMINE	8
RIBOFLAVIN	*
NIACIN	10
CALCIUM	*
IRON	2

* CONTAINS LESS THAN 2 PERCENT OF THE U.S. RDA OF THESE NUTRIENTS

AUNT EM'S INC
RICEVILLE, IOWA 10101

IF YOU ARE NOT SATISFIED WITH THIS PRODUCT SEND THE UNUSED PORTION BACK AND WE WILL GLADLY GIVE A REFUND.



Minute Chef

[illegible]

MICROWAVE PREPARATION

[illegible]

NUTRITIONAL INFORMATION PER SERVING

Serving size	[illegible]	Fat	[illegible]
Servings Per Container	1	Cholesterol	[illegible]
Calories	[illegible]	Sodium	[illegible]
Protein	[illegible]	Potassium	[illegible]
Carbohydrate	[illegible]		

PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCE

Protein	[illegible]	Riboflavin	[illegible]
Vitamin A	[illegible]	Niacin	[illegible]
Vitamin C	[illegible]	Calcium	[illegible]
Thiamine	[illegible]	Iron	[illegible]

DIABETIC EXCHANGES

[illegible]

INGREDIENTS: [illegible]

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CAREER OPPORTUNITIES IN THE FIELD OF PACKAGING AGRICULTURAL PRODUCTS

- Packaging Engineer
  - plans, designs, develops, and produces containers for goods
  - decides on materials to be used for containers
  - calculates cost of containers
  - insures product is protected by packaging
  - insures customer is protected by packaging
- Chemist
  - determines chemical make-up of materials
  - responsible for product analysis
  - assists in developing plastics essential to modern packaging
- Graphic artist
  - responsible for attractive packaging and labeling
- Electrical and Electronic Engineers
  - responsible for packaging technologies, especially those determining speed and flexibility of wrapping and sealing materials
- Mechanical Engineer
  - designs the machines that package materials
  - designs the machines that make the packages and packaging materials

Further Resources:

- **Packaging Education Foundation,** Reston International Center, Reston, VA 22091.
  - *Want a Job After College? We'll Give You One.* Career information booklet, 12 pages. 1983. Free on request to counselors.
  - *Opportunities in Packaging Science.* Free, 138 pages. Describes careers in packaging.
- **American Paper Institute,** 260 Madison Avenue, New York, NY 10016.
  - *Careers in the Paper Industry: What's So Special About Paper?* 4 pages. Single copy free; 100 copies $9.00. Brief history of papermaking, how the industry produces paper, and names and addresses of paper technology schools.
- **Society of Plastics Engineers,** 14 Fairfield Drive, Brookfield Center, CT 06805.
  - *Plastics as an Engineering Career.* Brochure. 8 pages. Free. Up to ten copies free to counselors.
  - *Professional Careers in the Polymer/Plastics Industries.* 10 pages. One free copy supplied for counselor use.
- **Chronicle Guidance Publications,** Aurora Street, P.O. Box 1190, Moravia, NY 13118-1190.
  - *Illustrators, Technical.* Brief 287. $3.00 postpaid.
  - *Industrial Designers.* Brief 126. $3.00 postpaid.
  - *Industrial Engineers.* Brief 284. $3.00 postpaid.
  - *Paper Manufacturing Workers.* Brief 378. $3.00 postpaid.
  - *Plastics products Manufacturing Workers.* Brief 370. $3.00 postpaid.
  - *Chronicle Occupation Brief and Reprint List.* Over 500 briefs and over 100 reprints. Free upon request.

NOTE: All of the career information is from "Packaging Engineers," Brief 274, 4th ed., D.O.T. 019; G.O.E. 05.03.09, *1987 Chronicle Guidance*, Publications, Inc., Moravia, NY 13118.

PACKAGING AGRICULTURAL PRODUCTS

- Expose a raw potato (whole) to fluorescent light for 5 days.
- Wrap a small piece of cheese in a paper napkin and leave it for a few days.
- Leave a piece of bread, unwrapped in a cardboard box overnight.
- Remove the cap from a bottle of soda and determine how quickly the beverage loses its carbonation.

Describe what happens to the product.

	Time exposed	Results
Potato		
Cheese		
Bread		
Soda		

ASSIGNMENT SHEET 1

PACKAGING AGRICULTURAL PRODUCTS

IX

OBJECTIVE 11 **Interpret a label.**

NAME ______________________________ SCORE ________

INTRODUCTION

Learning to read and understand package labels means that consumers have more control over what they eat and the amount of nutrients they get in their diet. Americans are becoming increasingly health-conscious, avoiding poly-unsaturated oils to keep cholesterol levels low, for example, and insisting on whole-grain breads and pastas.

All bread is made from wheat flour (except for clearly-labeled breads made from rye, soy, or some other non-wheat flour). So, unless the label states *100% whole* wheat, consumers may not be getting whole wheat bread made from the whole grain and including the nutritionally-rich bran.

You will use the "Minute Chef" label in Supplement 3 to complete this assignment sheet. This product is packaged in a retortable bag and needs no freezing or refrigeration until it is opened. The label provides more complete nutritional information than many packages. You will be seeing more of these labels in the future.

Diabetic exchanges are a system of diet control indicating the quantity of meat and vegetables in this product.

DIRECTIONS

Study the label in Supplement 3 and answer the questions.

1. How many calories are in one serving? ________________
2. If you are on a diet of 1,500 calories per day, what percentage of your daily allowance is in this package?

   ____

3. To lose weight on your 1,500-calorie diet, you can have no more than 50 grams of fat a day. Is the fat content in this product acceptable on your diet. ________________
4. What is the major ingredient in the product? ________________

   ____

5. What types of oils or fats are used?

____

6. What preservatives have been added?

____

7. What percentage of the calories in this product come from fat? Use this formula to find out.

- Multiply the number of grams of fat in the food by 9.
- Divide the answer in step 1 by the total number of calories in the product.

______ % of the calories come from fat

8. The National Academy of Sciences says the safe and adequate daily intake of sodium is 325-1,800 milligrams (mg) for children, 900-2,700 mg for teenagers and 1,100 to 3,000 mgs for adults. For breakfast you had a bowl of cereal that had 290 mg of sodium.

   a. Can you eat this product and be within the "safe and adequate" zone?

   ____

   b. Can your 4-year old sister, who also had cereal for breakfast eat this product and be within the "safe and adequate" zone?

   ____

ASSIGNMENT SHEET 2 — PACKAGING AGRICULTURAL PRODUCTS

OBJECTIVE 12 **Determine packaging, dating, and sealing methods.**

NAME ______________________ SCORE ________

INTRODUCTION

Along with the materials used to package products, sealing materials are designed to keep foods fresh. Customer needs and product requirements determine the materials used.

Products are hermetically sealed if they must be totally protected from gas and moisture, bacteria, yeast, molds, dirt and dust from packaging to customer use.

Even the seams must be hermetically sealed. Unopened rigid metal cans and glass bottles are the most common hermetically-sealed containers.

Products are not hermetically sealed if their quality, shelf-life, and attractiveness are affected by normal moisture, carbon dioxide or oxygen vapors.

On some canned products, only the top seam will be hermetically sealed because the can is manufactured as a single unit without side or bottom seams.

DIRECTIONS

Study Objectives 2-6 on materials and sealing methods. Go to the supermarket and examine several packages of each of the following food items for the information required below.

For each answer, write the brand name and product.

If the product such as ground beef is fresh and packaged in the store, write: Fresh ground beef

1. Find two canned products that are sealed on the top only and with a solid bottom and two canned products that are sealed on both ends.

Top seal only	Top and bottom seal
a. ____________________	a. ____________________
b. ____________________	b. ____________________

2. Find an example of each of the following types of sealing methods on snack products. Write the complete name of the product below.

Replaceable lid ________________________________

Rolled package top______________________________

Recloseable package ____________________________

3. Find three wrapped or bagged products that have been sealed by heating the package material and bonding it to itself.

4. Find a product with a sewn seam.

5. Check the bread shelves for different types of breads and rolls and briefly describe two or more different types of closures or seals.

6. Locate and write down the expiration-of-freshness date for:

Whipping cream ______________________________

Milk carton _________________________________

Milk jug ___________________________________

Cottage cheese ______________________________

Yogurt ____________________________________

7. Describe packaging, sealing, and date for one type of fresh meat.

8. Examine bakery products and determine which are dated and which are not.

Dated	Not dated

9. Examine canned items and describe the characteristics of the containers in terms of material, size, shape, and sealing methods. Briefly state why you think these products are packaged in this way.

Fish

Prepared meats, such as spaghetti sauce products

Fruit

Ham

Pickles

Baby foods

10. How are breakfast cereals packaged?

ASSIGNMENT SHEET 3

PACKAGING AGRICULTURAL PRODUCTS

OBJECTIVE 13

Discuss packaging practices.

NAME ________________________________ SCORE _______

INTRODUCTION

Most of us open packages and use the products or eat the food without thinking about what effects the packaging has on the freshness, flavor, and color of food or about the relationship between packaging and sales. Yet, very careful consideration is given to every aspect of packaging, as you are learning in this unit.

This assignment sheet asks you to think about why certain packaging decisions are made and what the effects are. You may want to look through your shelves, cabinets and refrigerator at home, or go to the supermarket for a wider choice of packages.

1. Sometimes products such as flour, cornmeal, oatmeal and other grains have bugs or worms in them after several weeks in the consumer's home. How might they have gotten in the package?

2. Name three packaged products with a short shelf life and three with a long shelf life. In general, what characteristics do the products in each group have in common?

Short shelf life:

Long shelf life:

Discussion

3. What are the influences on sales of shape, color, or kind of packages?

4. Discuss the idea that consumers choose items that are more convenient to use rather than items that are less expensive and less convenient. State your belief about the idea and discuss why you believe it.

ASSIGNMENT SHEET 4

PACKAGING AGRICULTURAL PRODUCTS

OBJECTIVE 14 **Calculate the cost of packaging.**

NAME ______________________________ SCORE _______

INTRODUCTION

Here are the factors a packager has to consider to calculate the real cost of packaging.

1. The cost of packaging machinery plus interest on money borrowed to pay for it.
2. The cost of operating and maintaining the machinery chosen.
3. The materials to be used.
4. How much material is to be used.
5. Using the most cost-efficient yet satisfactory material.

   EXAMPLE: New tray assemblies are very satisfactory as product packages and have the added advantage of requiring far less space in transportation.

6. Labor costs.
7. Whether transportation costs are included.
8. Cost of overhead - building rent or payments, maintenance, electricity, water, etc.

DIRECTIONS

Calculate the per unit cost of packaging 3 pounds of ground beef. It is to be placed on an absorbent liner on a plastic tray, shrink-wrapped, labeled with contents, cost, date and time of packaging, and placed in the appropriate bin in the supermarket.

NOTE: This is a fictional problem, but it indicates factors represented in calculating packaging costs.

The packager receives $3.60 per hour. The packager requires 1 minute per package to assemble, weigh, label, and place the package. The trays cost $25.00 per 1,000 units. The absorbent liner costs $12.50 per 1,000 units. The machine and material costs for wrapping one package costs $.24. The correctly printed label costs $.02. The cost of keeping the package in the bin for 6 hours until it is sold is $.15. Total cost of packaging is the sum of all these elements.

Find the cost of packaging the ground beef. Show your work.

Answer ______________________________

ASSIGNMENT SHEET 5

PACKAGING AGRICULTURAL PRODUCTS

IX

OBJECTIVE 15

Design a package for an agricultural product.

INTRODUCTION

Packaging is a complex undertaking. Follow the directions to limit the scope of your assignment. Use Supplement 2 as a guideline for factors to consider in your design.

DIRECTIONS

- Consider the packing needs of the product. Include:
  - Product protection
  - Consumer attractiveness
  - Material needs
  - Closure and sealing needs
  - Shelf-life needs
  - Label requirements
  - Ease of disposal
  - Tamper-evident/tamper-resistant needs
- Label the design.

  EXAMPLE: *Design For A Package Of Potato Chunkies*

  - Present your design to the class in an oral report with a drawing or a construction of a package. Explain why you made the choices you did.
  - Package description should include the shape of the package, material, sealing method, the weight of its contents, and the label colors to be used.

ASSIGNMENT ANSWERS — PACKAGING AGRICULTURAL PRODUCTS — IX

ASSIGNMENT SHEET 1

1. 310
2. 20.6% 310 — 1500
3. Yes
4. Beef
5. Soybean oil, bacon fat, corn oil
6. None
7. 40%
   15 X 9 = 135 ÷ 310 = 44%
8. a. Yes
   b. Yes

ASSIGNMENT SHEET 2

Student should answer all questions completely.

ASSIGNMENT SHEET 3

NOTE: Answers are students' opinions. Evaluate reasoning, clarity of expression, critical thinking, sentence structure, spelling, grammar, and appropriate sequence of ideas.

ASSIGNMENT SHEET 4

Packager's wage: $3.60 ÷ 60 = $.06

Cost of tray: $25.00 ÷ 1000 = $.025 rounded ÷ .03

Cost of liner: $12.50 ÷ 1000 = $.0125 rounded to $.01

Machine and wrap cost = $.24

Label cost: = $.02

Storage cost: = $.15

Total $.51

ASSIGNMENT SHEET 5

Did the student

____ 1. Decide on a product

____ 2. Determine

- a. merchandising requirements
  - I. consumer acceptability
  - II. shelf life needs

____ 3. Choose an acceptable container

- a. material
- b. size
- c. shape
- d. sealing method

____ 4. Draw, describe, or make label conform with FDA regulations

____ 5. Draw, describe, or make a package to conform with the choices made for the above product

____ 6. Provide an acceptable classroom presentation

WRITTEN TEST

PACKAGING AGRICULTURAL PRODUCTS

IX

OBJECTIVE 1

Match terms associated with packaging agricultural products to their correct definitions. Write the correct letters in the blanks.

____ 1. Capable of decaying and being absorbed by the environment

____ 2. United States Department of Agriculture

____ 3. Container that does not come in direct contact with the food

____ 4. Length of time a product may be expected to remain in satisfactory condition on a shelf

____ 5. A transparent paperlike product made from processed wood fibers

____ 6. Condition in which a package is fully protected against dirt, dust, bacteria, fungus, insects, and other damaging elements

____ 7. Capable of being reused as a result of breaking up, cleaning, and reprocessing the raw materials

____ 8. Brown, unbleached paper used for strong grocery bags and wrapping

____ 9. Formed of or set into thin layers of different materials

____ 10. Process in which two or more films of plastic, foil, or paper may be fed through a machine to form a multi-layered material suitable for packaging

a. Cellophane
b. Poly
c. USDA
d. Primary container
e. Sealing tape
f. Recyclable
g. Strapping material
h. Biodegradable
i. Corrugated
j. Tamper-evident
k. Retorted
l. Hermetic
m. Co-extrusion
n. Putrid
o. Kraft paper
p. Antiseptic
q. Shelf life
r. Secondary container
s. Label
t. Tamper-resistant

___11. Container that comes in direct contact with the food

___12. Packaging designed to make illegal or harmful entry into the product as difficult as possible

___13. Packaging material consisting of two or more films or layers of different materials

___14. Food and Drug Administration

___15. Any display of written, printed, or graphic matter on the immediate container of any customer commodity

___16. Free from disease-producing bacteria and not likely to putrefy

___17. Package on which the seal or wrapper is visibly and immediately damaged upon opening

___18. Greek prefix meaning "many"

___19. Any container or wrapping in which food is enclosed for use, delivery, or display of that product to the customer

u. Tamper-proof
v. Laminated
w. Cheese wrapper
x. Multilayered
y. Brand name
z. Package
aa. Aseptic
bb. Waxed
cc. FDA

OBJECTIVE 2

List general requirements for food packaging. List six requirements.

____

____

____

____

____

____

____

OBJECTIVE 3

Select from a list true statements about types of packaging. Write an "X" in the blank before each true statement.

____ 1. All primary containers are made of materials strictly monitored by the government.

____ 2. Cans cannot be hermetically sealed.

____ 3. Glass causes a chemical reaction with the contents.

____ 4. Retortable pouches are capable of withstanding high temperatures.

____ 5. Retortable pouches can be processed in a shorter time than jars or cans.

____ 6. Boxes do *not* have to be specially processed when used as a primary container.

____ 7. Bags are relatively flat containers that stack, store, and travel more economically.

____ 8. Retortable pouches can provide better nutritional quality than jarred or canned products.

____ 9. Aluminum is a light-weight material that is recyclable.

____ 10. Retortable pouches are not flexible.

OBJECTIVE 4

Define biodegradable, degradable, and recyclable materials. Write the correct answer in the blank.

Biodegradable—____

____

Degradable—____

____

Recyclable—____

____

OBJECTIVE 5

Select from lists statements about wrapping materials. Circle the correct answer. Items may have more than one answer.

1. Paper
   a. is made from polyester resin.
   b. is sometimes bleached to add strength to it.
   c. is sometimes treated to become more absorbent.
   d. has limited sealing and printing options.
2. Kraft paper
   a. is strong paper used for box liners.
   b. is used for secondary containers.
   c. is very expensive.
   d. is made of plastic products.
3. Edible coatings
   a. are used in space travel.
   b. are used inside tin cans.
   c. microwave well.
   d. may be made of confectioner's sugar.
4. Polycarbonate film
   a. is more expensive to produce than co-extruded plastics.
   b. provides hot-fill strength for boil-in-the bag items.
   c. is limited to non-food products because it is toxic.
   d. resists the development of pin holes.
5. Aluminum foil
   a. may be recycled.
   b. is in short supply.
   c. is strong enough to stand handling abuse.
   d. provides a total barrier against moisture, gas, light.

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6. Flexible packages

   a. may never be microwaved.

   b. must be cooked in a conventional oven.

   c. are made by laminating several materials together.

   d. have semi-rigid sides.

OBJECTIVE 6

List sealing methods used in packaging.

Bottles and jars
Write five ways bottles and jars may be sealed in the spaces below.

Bags
Write four ways bags may be sealed in the spaces below.

Boxes
Write two ways boxes may be sealed in the spaces below.

OBJECTIVE 7

Define terms associated with dating on food labels. Write the correct definition after the word.

Pack date ______________________________

____

Sell date ______________________________

____

Freshness date ______________________________

____

Expiration date ______________________________

____

OBJECTIVE 8

List in order the information to be printed on an approved label.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________

OBJECTIVE 9

Select from a list true statements about bar codes. Place an "X" in the blank before each true statement.

____1. The decoded message from the bar-code can tell what an item costs.

____2. Binary numbers were used in arithmetic before computers were invented.

____3. A bar-code is a label made up of wide and narrow black strips on a white background.

____4. Consumers accepted bar-code technology as soon as it was invented.

____5. Bar codes are used to keep track of inventory.

____6. Computers read bar-code information through a special scanner.

____7. Bar-code technology was invented in the 1980's.

____8. Binary numbers can be programmed to represent all the numbers and all the letters used in the English language.

____9. Bar-codes are only used in grocery stores.

____10. The scanner uses light to transform the message into electrical impulses that a decoder translates into binary numbers.

____11. Scanners are always expensive and complicated devices.

OBJECTIVE 10 **Select from a list factors affecting shelf life.** Write an "X" in the blank before each factor.

____ 1. Laminating the package materials provides more effective barriers against disease, dirt, gas, and odor contaminants.

____ 2. Aseptic packaging can contribute significantly to shelf life.

____ 3. Lamination is more effective than aseptic packaging.

____ 4. Dates on packages indicate the time that the product is no longer consumable.

____ 5. Marketing techniques that move the product to the consumer quickly can affect shelf life.

____ 6. Locally-produced products have a longer shelf life than products transported more than 1,000 miles.

____ 7. Dates on packages tell the customer about the expected shelf life of a product.

____ 8. Brightly-colored packages have a longer shelf life than plain-colored packages.

NOTICE The following assignment sheets are not part of the written test. If they have not been completed, check with your instructor.

OBJECTIVE 11 **Interpret a label.** SCORE ________

OBJECTIVE 12 **Determine packaging, dating, and sealing methods.** SCORE ________

OBJECTIVE 13 **Discuss packaging practices.** SCORE ________

OBJECTIVE 14 **Calculate the cost of packaging.** SCORE ________

OBJECTIVE 15 **Design a package for an agricultural product.** SCORE ________

WRITTEN TEST ANSWERS

PACKAGING AGRICULTURAL PRODUCTS

IX

OBJECTIVE 1

1. h
2. c
3. r
4. q
5. a
6. l
7. f
8. o
9. v
10. m
11. d
12. t
13. x
14. cc
15. s
16. aa
17. j
18. b
19. z

OBJECTIVE 2

Answer may include any six of the following:

- Be nontoxic
- Offer protection against germs, dirt, insects, rodents
- Keep moisture in or out as product requires
- Keep gas (carbon dioxide, oxygen) in or out as required
- Be tamper-resistant or tamper-evident
- Be easy to open
- Containers must have pouring spouts for pouring contents
- Have reseal features if contents are to be stored
- Be impact resistant
- Be easily disposed of
- Be able to carry printed information well
- Be reasonably priced

- Be adaptable for special features
- Protect the product from light damage
- Containers may be transparent to allow customer to see packaged product

OBJECTIVE 3

1, 4, 5, 8, 9

OBJECTIVE 4

- **Biodegradable materials** — are those that can be returned to the earth where microscopic organisms in the soil break down the materials and convert them to soil.
- **Degradable materials** — are those which may be absorbed by the atmosphere but are not returned to the earth. Microscopic organisms cannot break down these materials.
- **Recyclable materials** — are those which can be put to another use after certain processes change and reconstruct them.

OBJECTIVE 5

1. c
2. b
3. a, d
4. b, d
5. a, d
6. c

OBJECTIVE 6

Bottles and jars
Answer may include any five of the following:

- Screw on
- Lug top
- Crimp-on top
- Metal/plastic secured with a strip of plastic or metal
- Taped
- Dispenser

Bags
Answer may include any four of the following:

- Sewing/stitching
- Pasting
- Metal tie
- Staple
- Plastic clip

Boxes
Answer may include any two of the following:

- Heat sealed
- Strapped
- Glued

OBJECTIVE 7

- **Pack date**—The date the product was processed or packaged.
- **Sell date**—Last date on which a store may sell a product.
- **Freshness date**—The product will not be at the height of freshness after this dare.
- **Expiration date**—The last date a product should be used.

OBJECTIVE 8

1. Name of food
2. Serving size
3. Number of servings per package
4. Number of calories
5. Weight in grams of protein, carbohydrate fat, cholesterol and sodium per serving
6. percentage of U.S. RDA's
7. Other information

OBJECTIVE 9 1, 3, 5, 6, 8, 10

OBJECTIVE 10 1, 2, 5, 7, 9

OBJECTIVE 11	Refer to Answers to Assignment Sheet 1.
OBJECTIVE 12	Refer to Answers to Assignment Sheet 2.
OBJECTIVE 13	Refer to Answers to Assignment Sheet 3.
OBJECTIVE 14	Refer to Answers to Assignment Sheet 4.
OBJECTIVE 15	Refer to Answers to Assignment Sheet 5.

OBJECTIVE SHEET

PRESERVING AGRICULTURAL PRODUCTS

X

INTRODUCTION

Safe food preservation is essential to ensure a reliable, available food supply. A basic knowledge of preservation methods and related topics is necessary for people in many agricultural fields and is useful to any consumer.

UNIT OBJECTIVE

After completing this unit, the student should be able to describe basic preservation methods and ways to prevent bacterial contamination. The student will demonstrate these competencies by completing the assignments sheets, job sheets, practical tests and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with preserving agricultural products to their correct definitions.
2. Select from a list true statements about the history of food preservation.
3. Discuss the major factors in bacteria and microorganism control.
4. Describe major methods of preserving fruits and vegetables.
5. Select from a list processes used to preserve meats, fish, and poultry.
6. Describe two methods for preserving dairy products.
7. Arrange in order the major steps in canning fruits and vegetables.
8. List the four steps involved in freezing fruits, vegetables, and meats.
9. Select from a list true statements about the various types of freezing and refrigeration.
10. Determine the effect of light on cured meat. (Assignment Sheet 1)
11. Evaluate the effect of packaging on preserving frozen food. (Assignment Sheet 2)

12. Determine appropriate methods of preservation for different foods. (Assignment Sheet 3)

13. Demonstrate the ability to

    a. Make jerky. (Job Sheet 1)

    b. Determine the presence of bacteria and other microorganisms. (Job Sheet 2)

    c. Dry fruits and vegetables. (Job Sheet 3)

SUGGESTED ACTIVITIES

PRESERVING AGRICULTURAL PRODUCTS X

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.
- Obtain Rodac plates from Birko, Corporation, Amarillo, Texas, (806) 376-9250 (as of January 1, 1990 cost is $1.25 per 9-sample plate plus $3.25 per 30-40 plate sampler tape. Plates to test for specific bacteria are also available.).
- Sodium bisulfate can be purchased at any drug store. Make drying trays with screen frames and cheesecloth or nylon screening or purchase drying trays.
- Order other supplies for drying fruits and vegetables, making jerky, experimenting with cured meat, and other suggested activities.
- Obtain samples of common and uncommon canned, dried, and frozen foods.
- Obtain samples of products packaged and/or preserved by other means.
- Arrange field trips to: cannery, processing plant, etc.

DELIVERY

Objectives 1 through 4

- Discuss common and uncommon preservation methods.

- Discuss the food preservation techniques area natives used.
- Invite a home economist to discuss how changes in today's lifestyles have affected the food preservation industry.
- Have students suggest how history was changed by modern food preservation, how our lives might be affected by a lack of this modern technology, and how the technology may continue to change to meet future needs.
- Conduct a mock inspection of your kitchen facilities. Invite your area health inspector to lead the inspection.
- Visit a local food preservation or preparation establishment to observe steps taken to prevent microbial infection.

Objective 5

- Students may be surprised at the variety of meat products available. Have students list examples of each type of packaging listed.
- Have students list meat products using more than one preservation method i.e. bacon is cured and vacuum packed.
- Mention that other methods are also used: jerky is dried, sausages are fermented, etc.
- Smoke a piece of meat or visit a smokehouse or meat curing facility in your neighborhood.
- Make jerky (Job Sheet 1).

Objective 6

- Visit a dairy or invite a dairy person to visit the class. Possible topics include sanitation and safety during processing, research and testing, and variety of dairy products.
- Show the class examples of raw, skim, homogenized, and evaporated milk.
- Discuss other fermenting processes the students may be familiar with. Include yeast in bread, ethyl alcohol in medicines fermented from grain, and decomposition of plants and animals in the soil.

Objective 7

- Visit a cannery.
- Can foods in class. Invite a home economist to demonstrate canning.
- Tell students people used to die of lead poisoning from the lead soldering in cans.
- Explain and demonstrate what a vacuum is. Half fill a glass jar with water. Place a piece of moist cardboard over the top of the jar. Push gently down on the cardboard, "burping" air out of the jar until the cardboard is sealed to the surface of the jar. Turn the jar upside down. The water will remain at the bottom of the jar because no air is available to displace it.

Objectives 8 and 9

- Visit a local meat locker, processing plant, or other commercial establishment with freezing facilities.
- Have students begin Assignment Sheet 2.
- Freeze potatoes with and without blanching and compare the results.
- Freezing can be a highly effective way to store food, as proven by the Eskimos, who have used the meat of frozen mammoths as food. This meat was 15-20,000 years old.
- Invite a chemist to use liquid nitrogen to freeze food and explain why the food reacts as it does.

  WARNING: If liquid nitrogen is used, be sure safety precautions are strictly followed.

APPLICATION

Objectives 10 and 11

- Use Assignment Sheet 1 to have students investigate the effect of light on cured meat.
- Use Assignment Sheet 2 to have students evaluate the effect of packaging on preserving frozen food.
- Invite a local grocer or food wholesaler to discuss these and other processes the food retailer must keep in mind when storing and displaying food items.

- Have students survey their kitchens at home for food storage effectiveness and safety.

Objective 12

- Use Assignment Sheet 3 to have students determine appropriate methods of preserving different foods.
- Invite a home economist or other preservation expert to discuss considerations in choosing a preservation method.
- Compare common fruits and vegetables which have been frozen, canned, or dried with each other and with fresh varieties.
- Ask students to list foods which are not canned, are not frozen, are not dried, or are only available fresh.

Objective 13

- Identify common dried foods such as coffee, beans, herbs, and raisins; "instant" dried foods such as potatoes, coffee, drink mixes, egg mixes, and powdered milk.
- Use Job Sheet 1 to teach students food preservation techniques they can do at home.
- Use Job Sheet 2 to have students determine the presence of bacteria and other microorganisms.
- Use Job Sheet 3 to teach students how to dry fruits and vegetables.

EVALUATION

Practical test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Give practical test.
- Reteach and retest as necessary.

Written test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.

- Give written test.

  NOTE: The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Publications

- Delona, Deanna, *How to Dry Foods*, HP Books, Tucson, Arizona, 1979.
- Hupping, Carol, *Stocking Up III*, Rodale Press, Emmaus, Pennsylvania, 1986.
- Obtain literature on preserving from your county extension agent.

UNIT REFERENCES

- *A Complete Course in Canning*, Vol. I, II, III, The Canning Trade, Inc., Baltimore, Maryland, 1987.
- Delona, Deanna, *How to Dry Foods*, HP Books, Tucson, Arizona, 1979.
- Fields, Marion L., *Laboratory Manual in Food Preservation*, AVI Publishing Co., Inc., Westport, Connecticut, 1977.
- Hupping, Carol, *Stocking Up III*, Rodale Press, Emmaus, Pennsylvania, 1986.
- Jackson, John M. and Byron M. Shinn, *Fundamentals of Food Canning Technology*, AVI Publishing Co., Inc., Westport, Connecticut, 1979.
- Lawrie, R.A., *Meat Science*, Pergamon Press, Oxford, 1985.
- *Meat in the Food Service Industry*, National Live Stock and Meat Board, Chicago, Illinois and National Association of Meat Purveyors, Tucson, Arizona 1977.

- *Milk*, American Dairy Association (pamphlet).
- *Milk and You*, Channing L. Bete Co., Greenfield, Massachusetts, 1960.
- Potter, Norman N., *Food Science*, Van Norstrand Reinhold International, New York, 1986.
- Price, James F., and Bernard S. Schweigert, *The Science of Meat and Meat Products*, 3rd Edition, Food and Nutrition Press, Inc., Westport, Connecticut, 1987.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, 2nd ed., and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Science 466	Identifies	Definitions	
	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 2	Language Arts 139	Comprehends	Instruction-written	Context
	Language Arts 217	Identifies	Information-written	Context
	Language Arts 134	Comprehends	Information-written	Cause effect/ relationships
OBJECTIVE 3	Language Arts 052	Composes	Draft/written	
	Language Arts 139	Comprehends	Information-written	Context
	Language Arts 134	Comprehends	Information-written	Cause effect/ relationships
	Language Arts 141	Comprehends	Information-written	Main idea
	Science 070	Describes/ Explains	Bacteria	Characteristics
	Science 369	Describes/ Explains	Organisms	Life cycle

	SKILL AREA/ CODE	VERB	LINK A	LINK B
	Science 114	Describes/ Explains	Chemical reaction	
	Science 058	Describes/ Explains	Acids/bases	pH
OBJECTIVE 4	Language Arts 099	Composes	Sentences	
	Language Arts 013	Applies/Uses	Definitions	
	Science 282	Describes/ Explains	Heat	Temperature
OBJECTIVE 5	Language Arts 147	Comprehends	Information-written	Sequence
	Science 467	Identifies	Definitions	Occupational
	Language Arts 217	Identifies	Information-written	Context
	Science 743	Identifies	Matter	Phases/States
	Science 472	Identifies	Matter	Chemical properties
OBJECTIVE 6	Science 369	Describes	Organisms	Life Cycle
	Science 068	Describes	Bacteria	
	Science 079	Describes	Biochemistry	Fermentation
OBJECTIVE 7	Language Arts 147	Comprehends	Information-written	Sequence
OBJECTIVE 8	Language Arts 147	Comprehends	Information-written	Sequence

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 9	Language Arts 132	Comprehends	Information-written	
	Language Arts 214	Identifies	Information-written	
OBJECTIVE 10	Science 042	Applies/Uses	Charts	
	Science 474	Identifies	Matter	Physical properties
	Science 017	Analysis/ Evaluates	Experiments	Data
	Science 016	Analysis/ Evaluates	Experiments	Controls
OBJECTIVE 11	Science 017	Analysis/ Evaluates	Experiments	Data
	Science 042	Applies/Uses	Charts	
	Science 018	Analysis/ Evaluates	Experiments	Inferences
	Science 047	Applies/Uses	Scientific methods	Observation
	Science 045	Applies/Uses	Scientific methods	Analysis
	Science 341	Identifies	Matter	Phases/States
	Math 034	Computes	Addition	Whole numbers
	Math 047	Computes	Division	Whole numbers
OBJECTIVE 12	Language Arts 136	Comprehends	Information-written	Charts/tables
	Language Arts 039	Collects/ Organizes	Information-written	Classification

	SKILL AREA/ CODE	VERB	LINK A	LINK B
	Science 042	Applies/Uses	Classification schemes	Charts/graphs
	Science 046	Applies/Uses	Scientific methods	Data gathering
	Science 470	Identifies	Food groups	
OBJECTIVE 13a	Science 045	Applies/Uses	Scientific methods	Analysis
	Science 047	Applies/Uses	Scientific methods	Observation
	Science 016	Analyzes/ Evaluates	Experiments	Data
	Science 014	Analyzes/ Evaluates	Experiments	Conclusions
	Language Arts 089	Composes	Drafts-written	Evaluation
	Language Arts 069	Composes/ Edits	Notes	
	Language Arts 035	Attends	Directions/task	
OBJECTIVE 13b	Science 497	Measures	Volume	Liquids/solids
	Language Arts 035	Attends	Directions/task	
	Science 489	Measures	Distance	Length
	Science 496	Measures	Time	
OBJECTIVE 13c	Science 493	Measures	Weight	
	Science 497	Measures	Volume	Liquids/Solids
	Language Arts 035	Attends	Directions/Task	

OBJECTIVE 1

Match terms associated with preserving agricultural products to their correct definitions.

- **Aging**—The process of storing meat in a controlled environment to increase tenderness and flavor
- **Blanching**—Exposing fruits or vegetables to heat, usually steam, for short periods of time to prepare them for preserving
- **Brine**—The fluid added to vegetables in preserving; contains salts
- **Exhausting**—A process step in canning in which the unsealed container and food are heated, expanding the food and forcing out any excess air or gas in the food or container
- **pH**—The measurement of the acid or alkaline quality of an item

  NOTE: The pH scale ranges from 1—14; 1-6 acid, 7 neutral, 8-14 alkaline.
- **Syrup (Sirup)**—The fluid added to fruits in preserving; contains sugars
- **Retorting**—A process step in canning in which the sealed can is heated to sterilize the food product

OBJECTIVE 2

Select from a list true statements about the history of food preservation.

- The earliest forms of preservation, salting and drying, were used by peoples throughout the world, including Eskimos, North and South American Indians, Egyptians, Greeks, Japanese, and Europeans.
- In the 1790's, France's involvement in a series of wars caused a serious food shortage among both military personnel and civilians. As a result, a French firm started the first large-scale commercial food processing (drying) facility in 1795.

- At the same time, an English confectioner living in Paris, Nicolas Appert, began publishing information about a new form of preserving fruits and vegetables known today as canning.
- In 1864 Louis Pasteur proved that food spoilage can be caused by microorganisms.

  NOTE: His research led to pasteurization, a heat-sterilization process commonly used in beverages such as milk.
- In 1880 a meat shortage in Britain led to the first attempts to freeze Australian meat for shipment to Europe.
- World Wars I and II increased a demand for easily stored and transported food for soldiers, and the Great Depression increased a demand for home preservation of food without the expense of canning. As a result, dried food products regained popularity and products such as military C-rations and "instant" foods were developed.
- In about 1940 home freezing and refrigeration became practical and common.
- Continuing technology is today introducing vacuum-packed meals, soft-pac canning, and other innovations.

OBJECTIVE 3 **Discuss the major factors in bacteria and microorganism control.** (Job Sheet 2)

In 1864 Louis Pasteur proved that microorganisms caused some foods to become diseased. From that point on, science has addressed the need to control the growth of bacteria, molds, and fungi in our foods. Today, sterile conditions and industry standards ensure safe food for all of us; yet, the need to combat these microorganisms continues.

Meats can be contaminated before slaughter, during slaughter, or during processing. The food industry is carefully regulated and inspected to ensure safe environments and practices.

Most industrial contamination can be prevented by observing three basic rules:

- **Keep it clean.**
- **Keep it cold.**
- **Keep it moving.** (Process foods as they are delivered).

Three major factors allow the growth of microorganisms which cause spoilage. **Moisture, temperature**, and **pH** levels can create environments where fungi, bacteria and molds will grow. They can also create environments that will kill microorganisms. In some cases, the three factors can be manipulated to prevent the growth of microorganisms, although they are not killed.

- Moisture—Drying cuts off the supply of moisture necessary for the growth of organisms, thus killing microorganisms.
- Temperature—Temperature extremes will kill microorganisms. While various organisms will survive in cold or hot temperatures, many are unable to grow when exposed to an extreme temperature.
- pH—The amount of acidity in the food. Bacteria in food with a high pH (alkaline) are more highly resistant to sterilization by heat (low pH - low heat resistance; high pH - high heat resistance). Food products are usually separated into four pH-based categories and their processing regulated accordingly.

  NOTE: When the canning industry was in its infancy, canning processes were kept secret. Each firm had its own methods and recipes. Poor procedures and a lack of scientific understanding of factors such as pH levels led to common outbreaks of botulism, a deadly disease caused by eating spoiled food. As the industry grew, research was shared and regulations were written and enforced. From 1940 - 1982, only 14 cases of botulism were confirmed in U.S. commercially canned foods in metal containers, resulting in only eight deaths.

OBJECTIVE 4

Describe major methods of preserving fruits and vegetables. (Supplement 1)

- **Canning**—Preserving food by placing it in a sealed container and sterilizing by heat.
- **Drying**—Preserving food by removing moisture.
- **Freezing**—Preserving food by lowering the temperature to below 32° F (0 ° C).
- **Curing**—Preserving food by adding a preserving agent such as salt, sugar, or brine.
- **Irradiation**—Short-term preservation by exposing fruits and vegetables to radiation which kills microorganisms and increases shelf life.

OBJECTIVE 5

Select from a list processes used to preserve meats, fish, and poultry.

When an animal is slaughtered, the bacteria in or on the carcass continues to grow. At the time of slaughter, however, the natural antibacterial processes in the carcass stop functioning. These lead to special problems in preserving. The processes most commonly used are

- **Freezing**—Is the most common method used. Unlike fruits and vegetables, meats can be frozen without being treated. Precooked meats are usually packed in sauce or gravy to enhance flavor.
- **Canning**—Is also commonly used. The product may be cooked before canning. Examples of canned foods are tuna, canned ham, corned beef hash, and canned chili.
- **Vacuum packing**—Is similar to canning. The product is placed in a plastic pouch, air is removed, the pouch is sealed, heated, and cooled. Lunchmeats and bacon are commonly vacuum-packed, but fresh meat has proven to be less marketable when vacuum-packed because it appears brown when the package is sealed. The normal red color returns when the package is opened.
- **Smoking and curing**—Are older methods of preserving meat. Smoking is preserving by exposing to smoke. Curing is a form of preservation using salts, brines, aging, and sometimes smoking. Curing is used mostly with pork today and is done more for taste than preservation.

OBJECTIVE 6

Describe two methods for preserving dairy products.

Microorganisms causing serious disease grow quickly in warm milk. For this reason, dairy products must be carefully handled. Careful control of sanitation and temperature are necessary. Many common preserving methods, such as freezing or canning, can only be successfully completed if other ingredients are added or if the milk is processed.

- **Pasteurizing**—The product is heated to a specified temperature (usually below 200° F) for a specified period of time then cooled. This process destroys the most harmful microbes but does not kill all bacteria.

- **Fermenting**—Bacteria is added to the product. The bacteria then secretes enzymes which speed up the product's chemical breakdown. Cheese, sour cream, and yogurt are fermented.

  NOTE: Homogenization is not a preserving method, but a blending method which distributes fat evenly through the milk.

OBJECTIVE 7

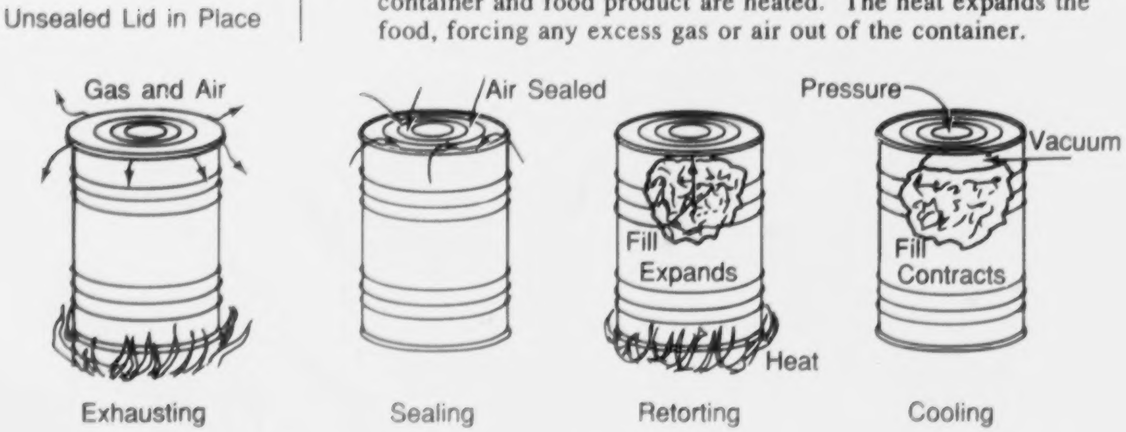
Arrange in order the major steps in canning fruits and vegetables.

NOTE: Actual steps and processes vary from food to food. These steps are the most common but may not be performed on every food, or may be performed differently than described here.

1. The raw product is cleaned and sorted.
2. The product is blanched. Blanching cleans the product, drives out gasses (allowing better fill control), helps preserve the product, and in some cases, improves the color and/or flavor of the food.
3. Coring, peeling, slicing, etc. is performed next. A variety of machines are available to perform these functions.
4. Fill media is added. Syrup is added to fruit, brine is added to vegetables.

   NOTE: In addition to fruits or vegetables and the fill media, many canned goods contain preservatives. A preservative is anything safely consumable added to enhance the preservation of food. Sugars, salts, and vinegar are common preservatives, as are various chemicals which have proven to be safe and effective.

5. Food and fill media are placed in containers.
6. Exhausting is performed. During this step, the unsealed container and food product are heated. The heat expands the food, forcing any excess gas or air out of the container.



7. The next step is retorting. The canned food is placed in a retort or autoclave. Temperature and pressure are increased to specified levels for a prescribed length of time, depending upon the contents.

8. Cooling is usually accomplished by running or sprayed water. During cooling, can contents contract, forming a vacuum within the can.

9. Finally, the cans are labeled and warehoused.

OBJECTIVE 8

List the four steps involved in freezing fruits, vegetables, and meats.

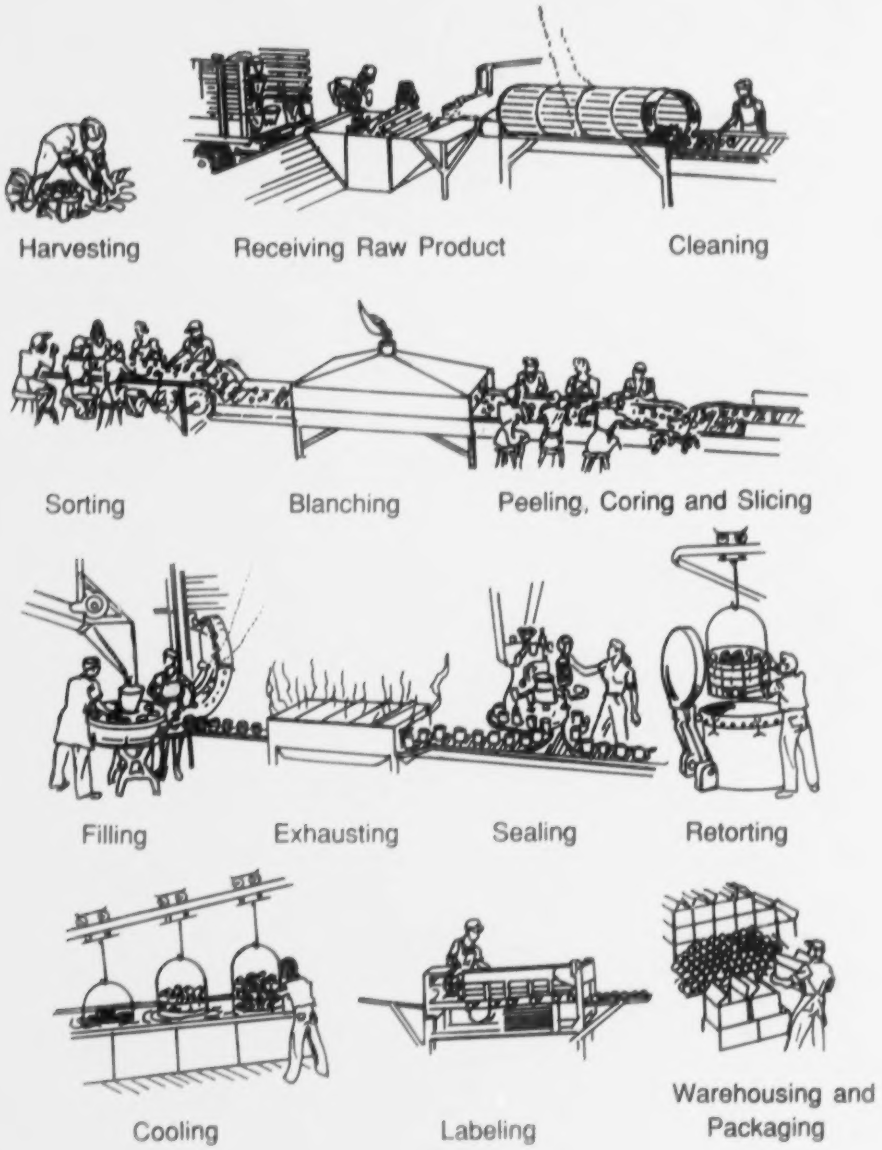
1. The raw product is **cleaned and sorted**.
2. The product is **prepared**. Fruits and vegetables are blanched. Foods are sliced, cooked, etc.
3. The product is **packaged** in appropriate wrapping.
4. The product is **frozen**.

OBJECTIVE 9

Select from a list true statements about the various types of freezing and refrigeration.

- **Slow freezing**—Usually accomplished by placing the items in a refrigerated cold room (10° F or lower).
- **Freezing by immersion**—Fast freezing by immersing the food in a refrigerant such as liquid nitrogen.
- **Airblast freezing**—Fast freezing by exposing packaged foods to cold, forced air. Airblast freezing is most commonly used in large, commercial plants to cool pre-cooked foods.
- **Indirect freezing**—Fast freezing by placing the packaged food in direct contact with a refrigerant-cooled piece of metal.

Typical Canning Factory Set-up



Harvesting

Receiving Raw Product

Cleaning

Sorting

Blanching

Peeling, Coring and Slicing

Filling

Exhausting

Sealing

Retorting

Cooling

Labeling

Warehousing and Packaging

Reproduced courtesy of American National Can Co.

METHODS OF PRESERVING SELECTED FRUITS AND VEGETABLES

Food	None	Dried	Canned	Frozen
Asparagus			canned	frozen
Beans, bush, green			canned	frozen
Beans, bush, yellow			canned	frozen
Beans, lima			canned	frozen
Beans, pole			canned	frozen
Beans, Garbanzo		dry		
Beans, Great Northern		dry		
Beans, Navy		dry		
Beans, Pinto		dry		
Beans, Red kidney		dry		
Beans, White kidney		dry		
Beets			canned	frozen
Broccoli				frozen
Brussel sprouts				frozen
Cabbage	none			
Carrots		dry		
Cauliflower				frozen
Celery	none			
Corn			canned	frozen
Cucumbers	none			
Lettuce	none			
Peas		dry	canned	frozen
Peppers, hot		dry	canned	
Peppers, sweet		dry	canned	
Potatoes		dry		frozen
Pumpkins			canned	
Radishes	none			
Spinach			canned	frozen
Squash, fall and winter				frozen
Sweet potatoes			canned	frozen
Tomatoes			canned	
Zucchini and Summer Squash				frozen
Apples		dry		frozen
Apricots		dry	canned	
Bananas		dry	canned	frozen
Blueberries			canned	frozen
Boysenberries			canned	frozen
Cherries, bush		dry	canned	frozen
Cherries, sweet		dry	canned	frozen
Coconuts		dry		
Grapefruit	none			
Dates		dry		
Figs		dry		
Melons	none			
Nectarines		dry	canned	
Peaches		dry	canned	frozen
Oranges	none			
Pears		dry	canned	
Pineapple		dry	canned	
Plums		dry	canned	
Raspberries			canned	frozen
Rhubarb		dry	canned	frozen
Strawberries			canned	frozen

CAREERS IN PRESERVING AGRICULTURAL PRODUCTS

- Cannery worker
- Machine operator
- Butcher
- Researcher
  - Genetics – Meat and dairy products
  - Chemistry
  - Radiation
- Technicians
  - Chemical
  - Production
  - Quality control
- Sales Representative
- Quality control engineer
- Packer
- Inspector
- Truck driver
- Mechanical engineers
- Nuclear engineers
- Teachers
- Marketing consultant

ASSIGNMENT SHEET 1

PRESERVING AGRICULTURAL PRODUCTS

NAME ______________________________ SCORE ________

OBJECTIVE 10 **Determine the effect of light on cured meat.**

INTRODUCTION Fluorescent lights can cause cured meats to lose their color. Although this change does not affect the meat's quality or indicate spoilage, it does make the meat less desirable to the consumer.

DIRECTIONS

1. Wrap 2 packages of 3 slices each of bacon in clear plastic wrap.
2. Put ice or coolant in an ice chest.
3. Place one package of bacon strips on the ice. Remove the cooler lid, exposing the bacon to fluorescent lights.
4. Place the other package of bacon strips in a refrigerator.
5. Leave the bacon packages for 24 - 48 hours.
6. Remove the packages from the cooler and refrigerator.
7. Unwrap the bacon and compare their appearance.
8. Cook the bacon and compare their taste and crispness.

Meats	Appearance	Crispness	Taste
Refrigerator **(no light)**			
Ice Chest **(fluorescent lights)**			

NAME ______________________________ SCORE _______

OBJECTIVE 11 **Evaluate the effect of packaging on preserving frozen food.**

INTRODUCTION Freezing food is often only as effective as the packaging used. Proper packaging keeps the food appealing in appearance, smell, and taste. It also protects the food from freezer burn (drying out of frozen food) and odors. In this exercise, the efficiency of common frozen food packaging will be rated.

DIRECTIONS

1. Cut a piece of round steak into seven pieces.
2. Wrap each piece in one of the types of packaging listed below and freeze.
3. Store the frozen meat for three weeks and thaw.
4. Compare the pieces for color; moistness—the amount of drip; look for freezer burn—white, wrinkled, dry area; and freshness—smell, general appearance.
5. Rate each piece from 1 to 10 in each category with "1" meaning poor and "10" meaning excellent.
6. Give each wrap an average grade by adding the scores in that row and dividing by 3.

Wrap	Color	Moistness	Freshness	Average
Foil				
Heavy duty foil				
Freezer paper				
Butter tub				
Initial store wrap				
Wax paper				
No wrap				

ASSIGNMENT SHEET 3

PRESERVING AGRICULTURAL PRODUCTS X

NAME ______________________________ SCORE ________

OBJECTIVE 12 **Determine appropriate methods of preservation for different foods.**

INTRODUCTION Different types of foods are affected differently by preserving. Some freeze well, but do not can well. Others can be canned, frozen, or dried successfully.

DIRECTIONS Use the chart in Supplement 2 to find out whether the foods listed can be canned, frozen, or dried successfully. Using the information on the chart, decide how these foods can best be preserved.

Food	None	Dried	Canned	Frozen
Lettuce				
Strawberries				
Melons				
Spinach				
Tomatoes				
Peaches				
Your favorite fruits				
Your favorite vegetables				

List some fruits and vegetables which can be pickled or fermented, then dried, canned, or frozen, such as cucumbers (pickled then canned).

ASSIGNMENT ANSWERS	PRESERVING AGRICULTURAL PRODUCTS X
ASSIGNMENT SHEET 1	Check that students have recorded a loss of color; crispness and taste should not be affected.
ASSIGNMENT SHEET 2	Procedures: Check that foods are sealed, that they are thoroughly frozen and thawed completely. Students should note the amount of drip that comes off of each product, rate the moisture, and freshness. Make sure each student completed the chart and determined an average.
ASSIGNMENT SHEET 3	Check that students have filled out the chart completely.

JOB SHEET 1

PRESERVING AGRICULTURAL PRODUCTS X

OBJECTIVE 13a

Make jerky.

TOOLS AND MATERIALS

- 2 1/2 cups Worcestershire sauce
- 1/2 cup Soy sauce
- 1/4 t. Lowry season salt
- One shake - garlic powder
- 1/4 t. Monosodium Glutamate (MSG)
- 1 T. black pepper
- 2-3 lbs meat

PROCEDURE

1. Cut meat into strips 3/4 to 1 inch wide and 14 inch thick or less.
2. Cover meat in marinate for 24 hours.
3. Put on oven racks and dry or smoke at 180° for 6-7 hours.
4. Test jerky: cool a piece; it should crack when bent but not break.

JOB SHEET 2

OBJECTIVE 13b

Determine the presence of bacteria and other microorganisms.

TOOLS AND MATERIALS

- Nine pieces of meat
- Rodac plate
- Rodac Sampler Tape
- Pencil and paper
- Vinegar
- Salt
- Sugar

PROCEDURE

1. Dip 2 pieces of meat in each of the preservatives, sugar, salt, and vinegar. Be careful not to touch the dipped surfaces. Leave 2 pieces of meat undipped. Press the last piece of meat to your hand.
2. Pull sampler tape off the spool far enough to cover the flat, square surface of the spool. Make sure the sticky side is out and no fingerprints are on the surface of the tape covering the square.
3. Press the tape to the piece of meat you are testing (taking the sample).
4. Gently press the sample to the jelly-like substance (called agar) in the Rodac plate. Each square of the plate holds one sample. Be careful not to crack the agar.
5. Record the piece of meat sampled, the treatment (i.e., "dipped in salt") and the square of the Rodac plate the sample was transferred to.
6. Repeat until all nine squares are filled.
7. Put the lid on the Rodac plate.
8. Turn the plate upside down.
9. Store the dish at room temperature for at least 24 - 48 hours.

10. Have your instructor check your work.

11. Put away tools and clean work area.

NOTE: Rodac plates are not reusable and should be thrown away.

12. Record the amount of time the samples were exposed to treatment.

13. Count the growths found in each square. Record your findings on the chart.

14. What conclusions can you draw from the results? How do the preservatives affect the growth of microbes?

JOB SHEET 3 — PRESERVING AGRICULTURAL PRODUCTS X

OBJECTIVE 13c

Dry fruits and vegetables.

TOOLS AND MATERIALS

- Dehydrator or oven
- 1/2 pound apples
- 1/2 pound carrots
- Water
- Sauce pan
- Slotted spoon
- Drying racks or trays (Use cheesecloth or nylon screening. Do not use metal screening material or baking sheets).
- Vegetable steamer
- Range top
- Cornstarch
- Sodium bisulfate (a preservative, available at any drug store)
- Two mixing bowls
- Measuring spoons
- Oven thermometer
- Wooden blocks approximately 2 inches square
- Towels and pot holders

NOTE: Use dehydrator directions rather than oven degree settings listed here if a dehydrator is used.

PROCEDURE

1. Turn oven to lowest possible temperature.
2. Use thermometer to gauge temperature. Adjust as necessary to reach a constant temperature of 140 degrees.
3. Wash apples and carrots.

4. Peal and trim apples and carrots. Core apples.

5. Cut carrots and apples into slices 1/4 inch thick.

6. In mixing bowl, mix 1 quart of water and 1/4 teaspoon sodium bisulfate. Add apples to the mixture and set it aside.

7. In sauce pan, mix 1 cup water and 1 teaspoon sodium bisulfate. Bring to boil.

8. Place carrots in vegetable steamer.

9. Place vegetable steamer over boiling water. Allow the carrots to blanch for 3 to 4 minutes.

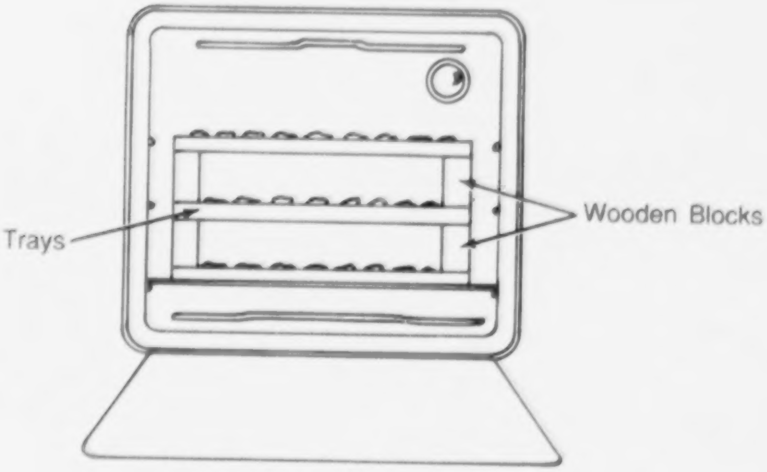
10. As the carrots blanch, mix 2 tablespoons cornstarch with 2 cups water.

11. When carrots are blanched, remove them from the vegetable steamer and dip them in the cornstarch solution.

12. Drain the carrots and place them in one layer on the drying trays.

13. Rinse apples thoroughly and place them on drying trays.

14. Place the drying trays in the oven or dehydrator. Use wooden blocks to stack drying trays if oven is used. Leave a 6 inch space between the bottom of the oven and the bottom tray and between the top of the oven and the top tray.



Oven or Dehydrator

15. Prop oven door open slightly with towel or pot holder.

16. Allow food to dry for approximately 2 hours. Apples are dehydrated when they are slightly crisp. Carrots should be very tough to brittle.

    NOTE: The apples will be delicious as is. Carrots can be chopped in a blender or food processor and used in salads, soups, carrot cakes or as baby food.

17. Remove from oven or dehydrator.

18. Have your instructor check your work.

19. Put away tools and materials and clean the work area.

PRACTICAL TEST 1 — PRESERVING AGRICULTURAL PRODUCTS X

JOB SHEET 1

Make jerky.

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	YES	NO
1. Cut meat into strips 3/4 to 1 inch wide and 14 inch thick or less.	_____	_____
2. Covered meat in marinate for 24 hours.	_____	_____
3. Put on oven racks and dried or smoked at 180° for 6-7 hours.	_____	_____
4. Tested jerky: cooled a piece; cracked when bent but did not break.	_____	_____

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:	4	3	2	1
Jerky cracked but did not break after cooling				

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATIONKEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

PRACTICAL TEST 2

PRESERVING AGRICULTURAL PRODUCTS X

JOB SHEET 2

Determine the presence of bacteria and other microorganisms.

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. ____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	YES	NO
1. Sampled each piece of meat.	____	____
2. Transferred samples to Rodac dish.	____	____
3. Maintained proper condition of agar, (no cracking, added moisture, etc.)	____	____
4. Prepared and stored Rodac dish 24-48 hours as instructed.	____	____
5. Counted and recorded corresponding bacteria colonies. Recorded treatment on chart.	____	____
6. Used proper tools correctly.	____	____
7. Performed steps in a timely manner.	____	____
8. Practiced safety rules throughout procedure.	____	____
9. Provided satisfactory responses to questions asked.	____	____
10. Put away tools and cleaned work area.	____	____

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Maintained testing integrity	4	3	2	1
Took adequate sample and transferred it correctly	4	3	2	1
Maintained adequate records	4	3	2	1
Came to correct conclusions	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

JOB SHEET 3

Dry fruits and vegetables.

Student's name ______________________________ Date ___________

Evaluator's name ____________________________ Attempt no. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

The student:	YES	NO
1. Set the oven temperature at 140° using an oven thermometer.	_____	_____
2. Cleaned, peeled, cored, and sliced the carrots and apples as directed.	_____	_____
3. Mixed sodium bisulfate and water in proper proportions.	_____	_____
4. Allowed apples to soak in sodium bisulfate solution.	_____	_____
5. Blanched carrots 3 - 4 minutes in steam over sodium bisulfate solution.	_____	_____
6. Drained carrots and placed them on drying tray.	_____	_____
7. Rinsed apples and placed them on drying tray.	_____	_____
8. Placed drying trays in oven or dehydrator, leaving adequate space for air circulation.	_____	_____
9. Propped oven door to allow air circulation.	_____	_____
10. Allowed food to dry for prescribed period of time.	_____	_____
11. Tested food for dryness.	_____	_____
12. Stored food.	_____	_____

The student:	YES	NO
13. Used proper tools correctly.	_____	_____
14. Performed steps in a timely manner.	_____	_____
15. Practiced safety rules throughout procedure.	_____	_____
16. Provided satisfactory responses to questions asked.	_____	_____
17. Put away tools and cleaned work area.	_____	_____

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Used tools safely	4	3	2	1
Mixed solutions carefully and accurately	4	3	2	1
Sliced and prepared food as directed	4	3	2	1
Produced acceptable dried foods	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATIONKEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

WRITTEN TEST

PRESERVING AGRICULTURAL PRODUCTS X

NAME ______________________________ SCORE _______

OBJECTIVE 1

Match terms associated with preserving agricultural products to their correct definitions. Write the correct letters in the blanks.

____ 1. A process step in canning in which the unsealed container and food are heated, expanding the food and forcing out any excess air or gas in the food or container

____ 2. The process of storing meat in a safe environment to increase tenderness and flavor

____ 3. A process step in canning in which the sealed can is heated, to sterilize the food product

____ 4. The fluid added to vegetables in preserving; contains salts

____ 5. The measurement of the acid or alkaline quality of an item

____ 6. Exposing fruits or vegetables to heat, usually steam, for short periods of time to prepare them for preserving

____ 7. The fluid added to fruits in preserving; contains sugars

a. Aging

b. Blanching

c. Brine

d. Exhausting

e. Freezing

f. pH

g. Preboiling

h. Retorting

i. Solution

j. Steaming

k. Syrup

l. Tempering

OBJECTIVE 2

Select from a list true statements about the history of food preservation. Write an "X" in the blank before each true statement.

____ 1. The earliest forms of preserving include drying and canning.

____ 2. Canning was first used in the United States.

____ 3. A meat shortage in Britain led to the first attempts to ship frozen meat to Europe.

____ 4. There are no changes or innovations in food preservation being introduced today.

____ 5. Salting and drying were used by peoples throughout the world.

____ 6. Food shortages brought on by wars led to the first commercial food processing.

____ 7. Milton Homogen's research led to the pasteurization process.

____ 8. The first commercial food processing was canning.

____ 9. A resurgence in popularity of dried and "instant" foods was the result of World Wars I and II and the Great Depression.

____ 10. Home freezing and refrigeration became practical by the turn of the century.

____ 11. A French firm began the first commercial food processing when it opened a food drying plant.

____ 12. Nicolas Appert published information about the canning process.

____ 13. Louis Pasteur discovered the link between microorganisms and food spoilage.

OBJECTIVE 3

Discuss the major factors in bacteria and microorganism control.

____

____

____

____

____

OBJECTIVE 4

Describe major methods of preserving fruits and vegetables. Write their name and a brief explanation of each process.

OBJECTIVE 5

Select from a list processes used to preserve meats, fish, and poultry. Write an "X" in the blank before any method commonly used to preserve meats, fish, and poultry.

____ 1. Irradiation

____ 2. Freezing

____ 3. Homogenizing

____ 4. Smoking

____ 5. Canning

____ 6. Candying

____ 7. Curing

____ 8. Stewing

____ 9. Vacuum packing

____ 10. Blanching

OBJECTIVE 6

Describe two methods for preserving dairy products. Write their name and a brief explanation of both processes.

OBJECTIVE 7

Arrange in order the major steps in canning fruits and vegetables. Write an "1" before the first step, a "2" before the second step, and so on.

____Fill media is added.

____Exhausting is performed.

____The raw product is cleaned and sorted.

____The product is blanched.

____The canned food is cooled.

____Retorting is performed.

____Coring, peeling, slicing, etc. is performed by hand or machine.

____The cans are labeled and warehoused.

____Food and fill media are placed in containers.

OBJECTIVE 8

List the four steps involved in freezing fruits, vegetables, and meats.

1. ____________________
2. ____________________
3. ____________________
4. ____________________

OBJECTIVE 9 **Select from a list true statements about the various types of freezing and refrigeration.** Write an "X" in the blank before each true statement.

____ 1. Slow freezing is usually accomplished by placing items in a refrigerated cold room.

____ 2. Indirect freezing is freezing by exposing foods to a cold, forced air.

____ 3. Freezing by immersion is a type of slow freezing.

____ 4. Placing food in contact with a refrigerant-cooled piece of metal is called direct freezing.

____ 5. Liquid nitrogen may be used to freeze foods.

____ 6. Airblast freezing is most commonly used in large, commercial plants to cool pre-cooked foods.

____ 7. Indirect freezing is a type of fast freezing.

NOTICE The following assignment sheets and job sheets are not part of the written test. If these activities have not been completed, check with your instructor.

OBJECTIVE 10 **Determine the effect of light on cured meat.** SCORE ________

OBJECTIVE 11 **Evaluate the effect of packaging on preserving frozen food.** SCORE ________

OBJECTIVE 12 **Determine appropriate methods of preservation for different foods** SCORE ________

OBJECTIVE 13 **Demonstrate the ability to**

a. **Make jerky.** RATING ______

b. **Determine the presence of bacteria and other microorganisms.** RATING ______

c. **Dry fruits and vegetables.** RATING ______

WRITTEN TEST ANSWERS

PRESERVING AGRICULTURAL PRODUCTS X

OBJECTIVE 1

1. d
2. a
3. h
4. c
5. f
6. b
7. k

OBJECTIVE 2

3, 5, 6, 9, 11, 12, 13

OBJECTIVE 3

Answer should include the following points:

- Moisture—Drying cuts off the supply of moisture necessary for the growth of microorganisms.
- Temperature—Temperature extremes will kill microorganisms. While various organisms will survive in cold or hot temperatures, many are unable to grow when exposed to an extreme.
- pH—The amount of acidity in the food. Bacteria in food with a high pH (alkaline) are more highly resistant to sterilization by heat (high pH-high heat resistance).

OBJECTIVE 4

- **Canning**—Preserving food by placing it in a sealed container and sterilizing by heat.
- **Drying**—Preserving food by removing moisture.
- **Freezing**—Preserving food by lowering the temperature of the food to 32° F (0° C).
- **Curing**—Preserving food by adding a preserving agent such as salt, sugar, or brine.
- **Irradiation**—Short-term preservation by exposing fruits and vegetables to radiation which kills microorganisms and increases shelf life.

OBJECTIVE 5 2, 4, 5, 7, 9

OBJECTIVE 6

- **Pasteurizing**—The product is heated to a specified temperature (usually below 200° F) for a specified period of time then cooled. This process destroys the most harmful microbes but does not kill all bacteria.
- **Fermenting**—Bacteria is added to the product. The bacteria then secretes enzymes which speed up the product's chemical breakdown. Cheese, sour cream, and yogurt are fermented.

OBJECTIVE 7

4	7
6	3
1	9
2	5
8	

OBJECTIVE 8

1. Cleaned and sorted.
2. Prepared
3. Packaged
4. Frozen

OBJECTIVE 9 1, 5, 6, 7

OBJECTIVE 10 Refer to Answers to Assignment Sheet 1.

OBJECTIVE 11 Refer to Answers to Assignment Sheet 2.

OBJECTIVE 12 Refer to Answers to Assignment Sheet 3.

OBJECTIVE 13 Refer to Practical Tests for Job Sheets 1 through 3.

OBJECTIVE SHEET

SPECIALIZED AND NONFOOD AGRICULTURAL PRODUCTS

XI

INTRODUCTION

Agricultural production has always included specialized and nonfood products. But as the economic and social environment changes, these products will become more important. Specialized and nonfood products create opportunities that can increase the production potential of all American agriculture.

UNIT OBJECTIVE

After completing this unit, the student should be able to identify nonfood and specialized agricultural products, and be able to discuss cotton and wool production. The student will demonstrate these competencies by completing assignment sheets and a written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with specialized and nonfood agricultural products to their correct definitions.
2. Match machinery used in the ginning system to its description.
3. Discuss the factors considered when grading cotton.
4. Match by-products of cotton to their correct descriptions.
5. Describe types of cotton products.
6. State classes of wool and their uses.
7. Discuss the two common systems of grading for wool.
8. State items to be considered when grading wool.
9. Complete statements about honey production.
10. Research a specialized or alternative agricultural enterprise. (Assignment Sheet 1)

PREPARATION

- Obtain materials to supplement unit.

  NOTE: See Suggested Resources.

- Review instructional outline for this unit. Modify time frames to suit class needs and plan activities for each class period.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Obtain wool samples. Samples may be obtained by writing: Wool and Mohair Laboratory USDA, AMS, LS, 711 "0" Street, Greeley, CO 80631. The price for 14 samples is $22.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Make arrangements for guest speakers. Supply speakers with specific objectives and other appropriate sections of the unit.

DELIVERY

Objective 1

- Introduce the unit. Discuss specialized and nonfood agriculture in general and the importance it has to the agricultural sector. Ask students to name nonfood agricultural products. Ask students if they know of anyone who is engaged in a form of alternative agriculture. Give examples of alternative agriculture.
- Invite an individual who is engaged in some form of specialized or alternative agriculture to speak to the class.
- Discuss terms used for nonfood and specialized agricultural products.

Objectives 2 and 3

- Discuss the process of cotton ginning.
- Use Supplement 1 to discuss the steps involved in the cotton ginning process.
- Take a field trip to a local cotton gin to see the cotton ginning process.
- Discuss the factors considered when grading cotton.

Objectives 4 and 5

- Discuss by-products of cotton.
- Discuss types of cotton products.
- Have students identify different cotton products in their home.
- Discuss the components used in the grading of cotton.

Objectives 6 through 8

- Discuss classes of wool.
- Discuss the American (blood) system and the Numerical Count (USDA) system of grading wool.
- Ask students to name products they use that are made from wool.
- Use wool samples to personally demonstrate the difference between the higher grades (80s, 70s, 64s) and the lower grades (46s, 44s, 36s). The higher grades of wool will be finer and softer to the touch. The lower grades will be coarser and have a more stiff feeling.
- Have each student compare a fine 80 grade wool sample with a course 36 wool grade sample.
- Discuss items to be considered when grading wool.
- Tell students that the uniformity of the fibers in the fleece are also an important factor in determining grade.

Objective 9

- Discuss honey production.

APPLICATION

Objective 10

- Use Assignment Sheet 1 to give students practice in researching a subject.

EVALUATION

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  NOTE: The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Publications

- Contact your local county extension agent for more information on alternative agricultural products. Or contact:

  The Center for Alternatives in Agriculture
  Oklahoma State University Cooperative Extension Service
  245 Ag Hall
  Stillwater, OK 74078
  (405) 744-6550

UNIT REFERENCES

- *Cotton, From Field to Fabric*, The National Cotton Council, Memphis, Tennessee.
- *Cotton, Profile of a Resourceful Industry*, National Cotton Council, Memphis, Tennessee.
- *Gillespie, James R., Modern Livestock & Poultry Production, Delmar Publishers, 1989.*
- Mayfield, William, Roy V. Baker, S. E. Hughes, and A. C. Griffin, *Ginning Cotton to Preserve Quality*, USDA Extension Service, Program Aid Number 1323, 1983.
- *Taking Advantage of Alternative Agricultural Opportunities*, OSU Extension Facts No. 869, Oklahoma State University Cooperative Extension Service, Division of Agriculture, Stillwater, OK, n.d.
- Verhalen, Laval M. and J. C. Banks, *Cotton Classing in Oklahoma*, Oklahoma State University Extension Current Report, CR2107, Cooperative Extension Service, Stillwater, Oklahoma.

BASIC ACADEMIC SKILLS

The following table identifies the basic academic skills that are reinforced in this unit of instruction. These basic academic skills were identified using *The Basic/Essential Skills Taxonomy*, second edition and verified during the validation process.

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 1	Language Arts 013	Applies/Uses	Definitions	
OBJECTIVE 2	Science 466	Identifies	Definitions	
OBJECTIVE 3	Science 342	Describes/ Explains	Matter	Physical properties
	Language Arts 092	Composes/ Edits	Reports/ Essays	Information supplying
	Science 124	Describes/ Explains	Color	
OBJECTIVE 4	Science 474	Identifies	Matter	Physical properties
	Science 475	Identifies	Matter	Uses
OBJECTIVE 5	Language Arts 092	Composes/ Edits	Reports/ Essays	Information supplying
	Science 345	Describes/ Explains	Matter	Uses
OBJECTIVE 6	Science 345	Describes/ Explains	Matter	Uses
	Science 342	Describes/ Explains	Matter	Physical properties

	SKILL AREA/ CODE	VERB	LINK A	LINK B
OBJECTIVE 7	Language Arts 139	Comprehends	Information-written	Context
	Science 467	Identifies	Definitions	Operational
OBJECTIVE 8	Language Arts 132	Comprehends	Information-Written	
	Language Arts 038	Collects/ Organizes	Information-Oral/written	
OBJECTIVE 9	Science 342	Describes/ Explains	Matter	Physical properties
	Science 345	Describes/ Explains	Matter	Uses
OBJECTIVE 10	Science 043	Applies/Uses	Models/ theories/laws	
	Science 037	Applies/Uses	Classification schemes	

INFORMATION SHEET

SPECIALIZED AND NONFOOD AGRICULTURAL PRODUCTS

XI

OBJECTIVE 1

Match terms associated with specialized and nonfood agricultural products to their correct definitions.

- **Aquaculture**—The production of fish and other aquatic species for human consumption or use
- **Costs of production**—The amount of resources needed to produce a commodity
- **Diversify**—To engage in a variety of operations
- **Enterprise**—A project or undertaking, a business organization
- **Exotic**—Not native to the place where found, unusual
- **Nonfood**—Products that are produced for other than human or animal consumption

  EXAMPLE: Sheep are raised for wool which is used to make clothing.
- **Nontraditional**—Differing from the standard practices or customs
- **Resources**—Factors used in the production of a product

  EXAMPLES: Land, money, water
- **Risk**—The chance of loss
- **Specialized**—Applying to a particular market or season

  EXAMPLES: Herbs and Christmas trees
- **Support services**—Products or services that are needed for an enterprise

OBJECTIVE 2

Match machinery used in the ginning system to its description. (Supplement 1)

- **Green boll trap**—Removes green bolls, rocks, and other heavy foreign matter from rough cotton
- **Air-line Cleaner**—Removes sand from cotton and breaks the bolls for further cleaning
- **Feed control**—Provides an even flow of cotton to the gin's cleaning and drying system
- **Tower Drier**—Has 16 to 24 shelves arranged so cotton must slow down while making turns through the machine. Heated air conveys the cotton through the shelves in 10 to 15 seconds
- **Inclined Cleaner**—Consists of six or seven revolving spiked cylinders that turn about 400 revolutions per minute. These cylinders convey the cotton over a series of grid rods or screens, agitate the cotton, and allow fine foreign materials such as leaf, trash and dirt to fall through openings for disposal
- **Stick Machine**—Uses centrifugal force created by high speed saw cylinders to sling off foreign material while the fiber is held by the saw.
- **Feeder**—Primary function is to feed seed cotton uniformly to the gin stand at controllable rates. Seed cotton cleaning is a secondary function.
- **Gin Stand**—Consists of a set of saws rotating between ginning ribs. The saw teeth pass between the ribs at the ginning point. The leading edge of the teeth is approximately parallel to the rib to pull the fibers from the seed rather than cutting them.
- **Lint cleaner**—Removes the fiber from the conveying air stream and forms it into a batt. The batt is introduced to the lint cleaner saw cylinder which normally rotates at approximately 1000 revolutions per minute. The saws carry cotton over grid bars which, aided by centrifugal force, remove immature seeds and foreign matter.
- **Bale press**—Compresses the cotton into the universal density bale with a normal density of 28 pounds per cubic foot for transportation and storage.

OBJECTIVE 3

Discuss the factors considered when grading cotton.

NOTE: Cotton grade is determined subjectively by the grader or classer, by examining its appearance and comparing it to physical and descriptive standards.

- Color—Classers consider three components in the color of the sample
  - Hue— refers to five categories in which the sample can be placed.
  - Lightness—refers to the lightness versus darkness of the sample.
  - Chroma—designates the intensity or degree of color.
- Leaf—The sample is measured for the amount and type of foreign matter it contains
- Preparation—Classers estimate the degree of smoothness of the sample.

OBJECTIVE 4

Match by-products of cotton to their correct descriptions.

- **Linters**—The short fuzz on the seed; linters provide cellulose for making plastics, explosives and other products; they are also processed into batting for padding mattresses, furniture, and automobile cushions
- **Cotton seed**—The meat of the cotton seed is called meal and is used in livestock feeds and fertilizer; some cotton seed also is used as a high-protein concentrate in baked goods and other food products
- **Cotton seed oil**—The cotton seed is crushed for oil which is used primarily for shortening, cooking oil, and salad dressing (cotton seed oil contains no cholesterol); limited quantities also go into soaps, insecticides, pharmaceuticals, cosmetics, and textile finishes
- **Cotton seed hulls**—Used in livestock feeds and a soil covering called mulch
- **Stalks and leaves**—Plowed under to enrich the soil

OBJECTIVE 5

Describe types of cotton products.

Cotton products are divided into three major areas:

- **Apparel or clothing material**—Cotton used in the production of clothing.
- **Domestic or household goods**—Cotton used to produce materials used in the home.

  EXAMPLES: Bedspreads, towels, curtains
- **Industrial fabrics**—Cotton used in industrial and medical products.

  EXAMPLES: Tarpaulins, book bindings

OBJECTIVE 6

State classes of wool and their uses.

In addition to grades, wool is classed according to use. The two major classes of wool are apparel wool and carpet wool.

- **Apparel wool**—Wool used in the making of clothing. Wool is further divided into worsted and woolen classes. Longer fiber wools are used in the worsted process. These make relatively strong yarn. Shorter fibers are used in the woolen process, making a weaker yarn.
- **Carpet wool**—Wool used in making carpet. Courser than apparel wool. The length of the wool, as well as the fineness, influences the use for which it is suited. Finer grades can be shorter than courser grades for the same classification.

NOTE: A major by-product of wool is wool grease. Wool grease in its purified form is known as lanolin. Lanolin has wide industrial use in the production of pharmaceutical, cosmetics, cutting oils, printing inks, lubricating greases, rust preventives and varnishes.

OBJECTIVE 7

Discuss the two common systems of grading for wool.

- **American (or Blood) System**—Contains seven grades of wool. Originally based on the percent of Merino breeding in the sheep. Today the system is used only to indicate the diameter of the wool fiber and does not indicate the amount of Merino breeding in the sheep.

- **Numerical Count (USDA) System**—Contains 16 grades which originally reflected the spinning count.

  NOTE: The spinning count is the number of hanks of yarn which can be spun from one pound of wool top (partially processed wool). A hank is 560 yards in length

OBJECTIVE 8

State items to be considered when grading wool.

- **Diameter of the fiber**—The diameter of a strand of wool is measured in microns to determine the fineness of the strand. The smaller the diameter of the fiber, the higher degree of fineness.
- **Length of fiber**—The length of wool influences the use for which it is suited. Finer grades can be shorter than coarser grades for the same use classification.

OBJECTIVE 9

Complete statements about honey production.

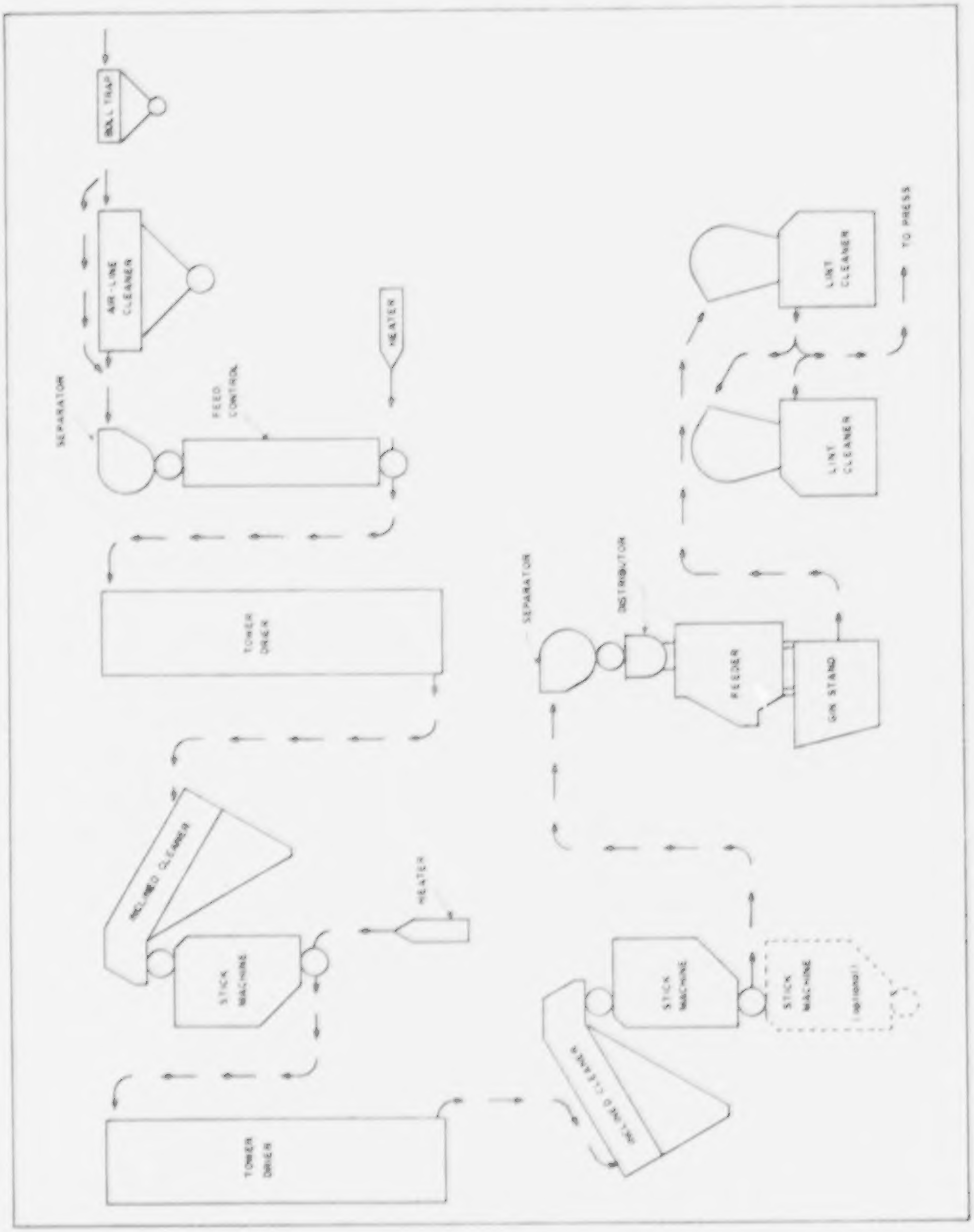
- Honey bees produce about 250 million pounds of honey per year in the United States.
- About 250,000 beekeepers, most of them hobbyists, manage over 4 million colonies in the United States.
- Commercial beekeepers earn their livelihood from the sale of honey and the rental of hives for pollination.

  NOTE: Honey bees unintentionally pollinate many cultivated crops. Plants pollinated by honey bees contribute indirectly to human diets because they are important food sources for livestock and wildlife.
- Honey bees manufacture 4 million pounds of beeswax per year.
- Honey bees also manufacture some lesser known substances such as bee pollen, bee venom, and royal jelly which are important ingredients in a variety of products.
- Honey is at its best when correctly cured and sealed in the comb.
- Honey must be extracted from the honey combs before being processed.

- Honey begins to deteriorate when taken out of the comb. The extent of deterioration depends on the processing methods used.

- Some beekeepers specialize only in the sale of bees to other commercial or hobby beekeepers as opposed to selling bee products.

GINNING SYSTEM


BOLL TRAP
AIR-LINE CLEANER
SEPARATOR
FEED CONTROL
HEATER
TOWER DRIER
INCLINED CLEANER
STICK MACHINE
HEATER
TOWER DRIER
INCLINED CLEANER
STICK MACHINE
STICK MACHINE (optional)
SEPARATOR
DISTRIBUTOR
FEEDER
GIN STAND
LINT CLEANER
LINT CLEANER
TO PRESS

538

Preliminary analysis of an alternative enterprise.

1. Is it technically feasible on your farm?

   Is it physically possible to produce the enterprise on your farm? Do you have appropriate climate, soils, water, equipment, and labor?

2. Is it economically feasible?

   Can you produce the enterprise at a profit? Do you know, or can you estimate with reasonable certainty, the expected costs of production for the enterprise?

3. Can you get needed financing?

   Many lenders know little about enterprises which are considered alternatives. Be prepared to give detailed information and a business plan for the enterprise.

4. Is there a market available, and do you have the necessary marketing skills?

   It is very important to plan for marketing before you plan for production. Many alternative enterprises do not have as well established markets as do traditional enterprises. However, innovative market planning can often find both direct and indirect marketing opportunities for alternative enterprises. Direct marketing refers to selling commodities directly to consumers. Methods of direct marketing for many alternative agricultural enterprises include roadside stands, farmers' markets, and pick-your-own operations. Indirect marketing of alternative enterprises usually means dealing with packing houses, brokers, wholesalers, and retail outlets.

5. Can you stand the risks?

   Any new enterprise involves risk. Major portions of the risk associated with alternative agricultural enterprises are price and yield variability. A useful way to evaluate the risk associated with an enterprise is to estimate the minimum returns or maximum losses that you can stand. Look at a worse case scenario and see if you can stand it.

Another source of risk relates to an individual's liability if he or she invites customers into the direct marketing operation. An individual may be liable for injuries experienced by customers in such circumstances. An individual who is considering direct marketing of an alternative enterprise should check with an insurance agent and attorney about any liability insurance that should be considered.

6. What support services are needed?

If you are considering an alternative agricultural enterprise, you should recognize that needed support services may not exist in your area. A lack of support services does not necessarily mean that you should avoid the enterprise. However, you should consider what services are not locally available, and where you will have to go to get them, or how you will get along without them. Such support services include marketing services, special equipment and supplies, and information services.

7. How does the enterprise match up with your personal interests?

Do your personal interests match up with the activities that you will have to carry out if you become involved with an alternative agricultural enterprise? For example, if managing temporary labor and dealing with city produce brokers is undesirable to you then there are some alternative enterprises you should avoid. Do you have the time and are you willing to give up that time to devote to an alternative enterprise?

Adapted from Oklahoma State University Cooperative Extension Service Fact Sheet No. 869, "Taking Advantage of Alternative Agricultural Opportunities."

IDENTIFY NONFOOD AGRICULTURAL PRODUCTS

DIRECTIONS Survey agricultural businesses in your area for examples of nonfood agricultural enterprises. Also, read newspapers and articles for examples of nonfood agricultural enterprises. Try to find five examples of nonfood agricultural enterprises and write them in the spaces provided. Provide a brief description of each enterprise.

1. ______________________________

____

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2. ______________________________

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3. ______________________________

____

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4. ______________________________

____

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5. ______________________________

____

____

IDENTIFY SPECIALIZED AGRICULTURAL PRODUCTS

DIRECTIONS Survey agricultural businesses in your area for examples of specialized agricultural enterprises. Also, read newspapers and articles for examples of specialized agricultural enterprises and write them in the spaces provided. Provide a brief description of each enterprise.

1. ______________________________

____

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2. ______________________________

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3. ______________________________

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4. ______________________________

____

____

5. ______________________________

____

____

PRELIMINARY ANALYSIS OF AN ALTERNATIVE ENTERPRISE

DIRECTIONS

Determine an alternative agricultural enterprise that you would be interested in. Use Supplement 2 as a guideline and answer the following questions. Please explain your answers.

1. Is it technically feasible on your farm?

2. Is it economically feasible?

3. Can you get needed financing?

4. Is there a market available, and do you have the necessary marketing skills?

5. Can you stand the risks?

6. What support services are needed?

7. How does the enterprise match up with your personal interests?

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ASSIGNMENT SHEET 1

SPECIALIZED AND NONFOOD AGRICULTURAL PRODUCTS

NAME ______________________________ SCORE _______

OBJECTIVE 10

Research a specialized or alternative agricultural enterprise.

INTRODUCTION

There is a wide variety of alternative agricultural products. Alternative agricultural products can be used to supplement other income or they may be the major source of income for an individual.

DIRECTIONS

Determine an alternative agricultural product that you are interested in researching. Go to the library and try to find as much information as you can about the subject. Talk to your local extension agent or others in your community to find out more. Write a one or two page report on your findings. Be sure to include information on production, processing and marketing.

ASSIGNMENT ANSWERS — SPECIALIZED AND NONFOOD AGRICULTURAL PRODUCTS — XI

ASSIGNMENT SHEET 1	Make sure that student has written a one to two page report. Check for grammatical and spelling errors.

WRITTEN TEST

SPECIALIZED AND NONFOOD AGRICULTURAL PRODUCTS

XI

OBJECTIVE 1

Match terms associated with specialized and nonfood agricultural products to their correct definitions. Write the correct letters in the blanks.

____ 1. The chance of loss

____ 2. Products or services that are needed for an enterprise

____ 3. The production of fish and other aquatic species for human consumption or use

____ 4. To engage in a variety of operations

____ 5. Not native to the place where found, unusual

____ 6. Factors used in the production of a product

____ 7. Applying to a particular market or season

____ 8. The amount of resources needed to produce a commodity

____ 9. A project or undertaking, a business organization

____ 10. Products that are produced for other than human or animal consumption

____ 11. Differing from standard practices or customs

a. Nonfood

b. Diversify

c. Exotic

d. Factors of production

e. Support services

f. Resources

g. Import

h. Enterprise

i. Specialized

j. Uncertainty

k. Costs of production

l. Risk

m. Necessary factors

n. Nontraditional

o. Aquaculture

p. Seasonal

q. Fish farming

OBJECTIVE 2

Match machinery used in the ginning system to its description. Write the correct letters in the blanks.

____1. Removes the fiber from the conveying airstream and forms it into a batt

____2. Removes green bolls, rocks and other heavy foreign matter from rough cotton

____3. Provides an even flow of cotton to the gin's cleaning and drying system

____4. Removes sand from cotton and breaks the bolls for further cleaning

____5. Consists of a set of saws rotating between ginning ribs

____6. Primary function is to feed seed cotton uniformly to the gin stand at controllable rates

____7. Consists of six or seven revovling spiked cylinders that turn about 400 revolutions per minute

____8. Has 16 to 24 shelves arranged so cotton must slow down while making turns through the machine

____9. Uses centrifugal force crated by high speed saw cylinders to sling off foreign material while the fiber is held by the saw

____10. Compresses the cotton into the universal density bale

a. Gin stand

b. Lint stand

c. Feeder

d. Lint cleaner

e. Gin trap

f. Air-line cleaner

g. Stick machine

h. Bale press

i. Feed control

j. Tower drier

k. Baler

l. Inclined cleaner

m. Green boll trap

n. Inclined stand

OBJECTIVE 3

Discuss the factors considered when grading cotton.

OBJECTIVE 4

Match by-products of cotton to their correct descriptions. Write the letter of the correct answer in the blank.

____ 1. The short fuzz on the seed

____ 2. Used in livestock feeds and fertilizer, also used as a high protein concentrate in baked goods and other food products

____ 3. Plowed under to enrich the soil

____ 4. Used in livestock feeds and a soil covering called mulch

____ 5. Used primarily for shortening, cooking oil, and salad dressing

a. Linters

b. Cotton seed oil

c. Kernels

d. Lint

e. Cotton seed hulls

f. Stems

g. Cotton seed

h. Stalks and leaves

OBJECTIVE 5 Describe types of cotton products.

OBJECTIVE 6 State classes of wool and their uses.

OBJECTIVE 7 Discuss the two common systems of grading for wool.

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OBJECTIVE 8 **State items to be considered when grading wool.**

____

____

____

____

OBJECTIVE 9 **Complete statements about honey production.**

1. Honey begins to ______________ when taken out of the comb.
2. Honey bees manufacture lesser known substances such as ____________________ , ____________________ , and ____________________ , which are important ingredients in a variety of products.
3. Commercial beekeepers earn their livelihood from the sale of honey and the ______________ of hives for pollination.
4. Honey bees produce about ______________pounds of honey per year in the United States.
5. Honey bees manufacture 4 million pounds of ____________ per year.
6. Honey is at its ______________ when correctly cured and sealed in the comb.
7. The extent of deterioration depends on the ____________ methods used.
8. Honey must be ______________ from the honey comb before being processed.

NOTICE The following assignment sheet is not part of the written test. If this acitivty has not been completed, check with your instructor.

OBJECTIVE 10 **Research a specialized or alternative agricultural enterprise.**

WRITTEN TEST ANSWERS

SPECIALIZED AND NONFOOD AGRICULTURAL PRODUCTS

XI

OBJECTIVE 1

1. l
2. e
3. o
4. b
5. c
6. f
7. i
8. k
9. h
10. a
11. n

OBJECTIVE 2

1. d
2. m
3. i
4. f
5. a
6. c
7. l
8. j
9. g
10. h

OBJECTIVE 3

Answer should include the following:

- Color—Classers consider three components in the color of the sample
    - Hue—refers to five categories in which the sample can be placed.
    - Lightness—refers to the lightness versus darkness of the sample.
    - Chroma—designates the intensity or degree of color.
- Leaf—The sample is measured for the amount and type of foreign matter it contains
- Preparation—Classers estimate the degree of smoothness of the sample.

OBJECTIVE 4

1. a
2. g
3. h
4. e
5. b

OBJECTIVE 5

- **Apparel or clothing material**—Cotton used in the production of clothing.
- **Domestic or household goods**—Cotton used to produce materials used in the home.
- **Industrial fabrics**—Cotton used in industrial and medical products.

OBJECTIVE 6

- **Apparel wool**—Wool used in the making of clothing. Further divided into worsted and woolen classes. Longer fiber wools are used in the worsted process. These make relatively strong yarn. Shorter fibers are used in the woolen process, making a weaker yarn
- **Carpet wool**—Wool used in making carpet. Courser than apparel wool. The length of the wool, as well as the fineness, influences the use for which it is suited. Finer grades can be shorter than courser grades for the same classification

OBJECTIVE 7

Answer should include the following points:

- American (or Blood) System
  - Contains seven grades
  - Originally based on the percent of Merino breeding in the sheep
  - Today indicates the diameter of the wool fiber

- Numerical Count (USDA) System
  - Contains 16 grades
  - Originally reflected the spinning count

OBJECTIVE 8

- Diameter of the fiber
- Length of fiber

OBJECTIVE 9

1. deteriorate
2. bee pollen, bee venom, royal jelly
3. rental
4. 250 million
5. beeswax
6. best
7. processing
8. extracted

OBJECTIVE 10

Refer to answers to Assignment Sheet 1.